Consulting Engineer



Photo by Fabian Bachrach

September 1960

ENOCH R. NEEDLES, partner in Howard, Needles, Tammen & Bergendoff, has few professional fields left to conquer. He has served as president of the American Institute of Consulting Engineers ('46), the American Road Builders' Association ('49 and '50), the American Society of Civil Engineers ('56), and the Engineers Joint Council ('58 and '59). Yet through it all, he has remained an outspoken individualist, who dares to disagree with currently popular plans for engineering unity.

Continued on page 18

PROTECT FLUORESCENT LIGHTING INSTALLATIONS



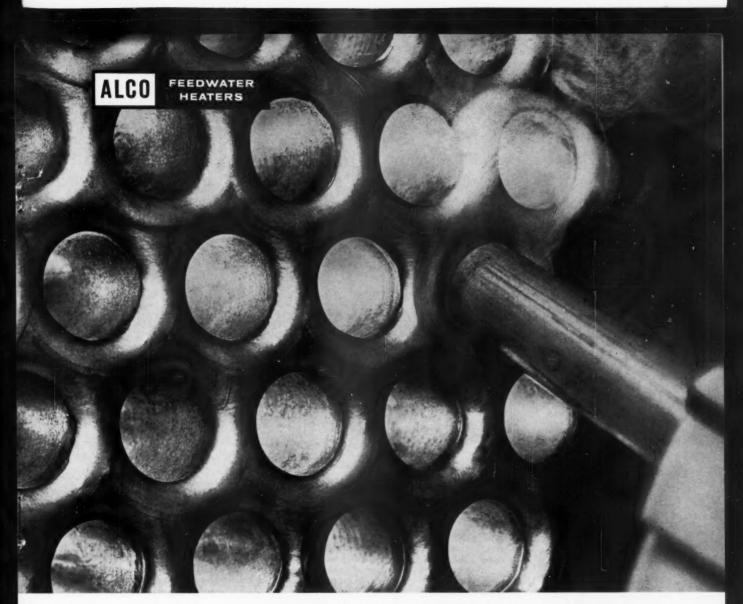
ADVAN-guard® is sealed in the ballast housing and pre-set to instantly and automatically trip out whenever the ballast is operating at higher than recommended temperatures. When heat decreases to normal operating temperature, ADVAN-guard® resets automatically and the ballast resumes operation, adding years to ballast life by preventing ballast operation at abnormal temperatures. To assure maximum protection for fluorescent lighting installations, provide ADVAN-guard® Fluorescent Lamp Ballasts. ADVAN-guard® is listed by Underwriters' Laboratories, Inc. Write for detailed literature.

"The Heart of the Lighting Industry."

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Tungsten-arc welding of heater tubesheet, using new Alco procedures, guards against expensive high-pressure tubesheet leaks.

THE NEW ARMOR IN HIGH-PRESSURE HEATERS

Feedwater heaters in today's central steam-power stations contain higher pressures and temperatures than ever before. Because of this, the inner armor of the heater must be flawless. Given the slightest pinhole or crack, high-pressure water chews out the forged steel of the heater's tubesheet at a geometric rate.

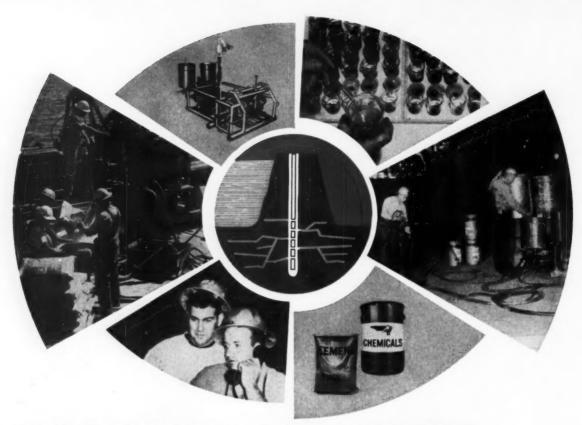
To block this quiet destruction, ALCO Products, Inc., has developed ways to get consistently tight welds at tube-tubesheet joints. ALCO's unequalled background in welding of all types has helped in setting up improved welding procedures. The result is your best protection against the expensive downtime that high-pressure tubesheet leaks cause.

Reliability like this is the first consideration in feedwater heaters. ALCO provides it in the design and construction of a complete line of heaters: low-and high-pressure, channel up or down, horizontal and vertical, with several types of available closures and many special design features for improved operation.

ALCO feedwater heaters are successfully serving in many of the country's most modern central stations, including stations operating on a supercritical cycle. If you are recommending or purchasing heaters, contact the nearest ALCO sales office, or write ALCO Products, Inc., Dept. 142, Schenectady, New York.

ALCO PRODUCTS, INC., New York · Sales Offices in Principal Cities · Makers of: Heat Exchangers Weldments · Locomotives · Nuclear Reactors · Diesel Engines · Springs · Steel Pipe · Forgings · Oil Field Equipment





FULL SCOPE OF SERVICE

Halliburton Full Scope Pressure Grouting Service offers a balanced selection of the best grouting methods and materials available today. To give you the complete picture of the many benefits of this outstanding service, Halliburton has prepared a comprehensive grouting brochure which is available now on request. A few of the advantages offered by Halliburton Pressure Grouting Service, and presented in this brochure, are outlined below.



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PUT THESE PRODUCTS AND TECHNIQUES TO WORK FOR YOU. When soil stabilization or water control problems point to pressure grouting...call on Halliburton...and Compare the Results!

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Consulting Engineer•

Wayne near Pleasant Street Saint Joseph, Michigan

For Engineers in Private Practice

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How Imaginative Engineering Put Taming Chicago's



John Dolio (right) in front of Powers Graph-O-Matic Control Panel with E. S. Anderson, engineer for the Illinois Psychiatric Institute.

The unusual temperature requirements specified for the new Illinois Psychiatric Institute presented an extraordinary challenge for John Dolio & Associates. This Chicago engineering firm was asked to provide an absolutely uniform temperature throughout the 11-story, T-shaped building. Because temperature variations cause extreme discomfort—even pain—to mental patients, the system had to be accurate, foolproof and automatic. Because Chicago temperatures rise or fall to extremes within hours—sometimes minutes—the system had to be capable of sensing the changing weather picture outside and automatically and simultaneously reacting inside.

The resulting design provides all the answers . . . in a Powers pneumatic control system that operates automatically 24 hours a day—every day—at a bare minimum of cost; a system that compensates instantly for sudden outdoor temperature changes; a system that can be checked and controlled by one man.

The result is a functional system of control where practical engineering principles were combined by the Dolio firm with a strong helping of ingenuity in order to whip some of the more unusual problems. For example, since chilled water was to circulate through ceiling heating-cooling panels, a safeguard against condensation was necessary. The engineers solved this problem with a series of dew point controls mounted at various locations in the ceilings. Thus, "controls on a control" prevent water temperature from falling to the point at which condensation could occur.

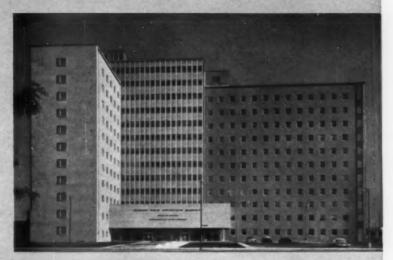


Phil Derrig, Chief Mechanical Engineer of the Dolio firm, inspects one of the dew point controls specially designed to prevent condensation of cold water in the ceiling heating-cooling panels.

Powers Temperature Control To Work Weather At Illinois Psychiatric Institute

Illinois Psychiatric Institute Chicago, III.

Illinois Supervising Architect:
Louis H. Gerding
Architects:
Shaw, Metz & Associates, Chicago
Associate Architects and Engineers:
Fugard, Burt, Wilkinson and Orth
Consulting Engineers:
John Dolio & Associates, Chicago
Heating, Air Conditioning Contractor:
Gallaher and Speck, Inc., Chicago
Ventilation: Zack Co., Chicago



JOB DETAILS

The system encompasses 12 temperature zones, each designed to operate independently in relation to individual zone exposure problems. Ten zones utilize ceiling heating and cooling panels at which hot and chilled water circulate from zone exchangers. Three-way control valves for the water are modulated by pneumatic thermostats in various rooms. Two zones — auditorium and stairwell — have only heat exchangers (the auditorium is supplied with individual conditioned air).

Master outdoor controls sense the changes in temperature outdoors and instantly reset submaster pneumatic thermostats at the zone exchangers. These indooroutdoor controls are engineered for foolproof maintenance of uniform zone temperatures.

A central control board, the heart of the Dolio design, monitors the complete heating, cooling and ventilating system. The building engineer alone can instantly

check 170 control points by merely referring to the Powers Graph-O-Matic Control Panel.

Temperature controls are inaccessible to patients.

All controls in the corridors are wall-mounted and cabinetenclosed; temperature sensors are mounted in ceiling
exhaust ducts.

Easy servicing and low maintenance are two big reasons why a pneumatic system of control was specified by this engineering firm. Efficiency at low cost is characteristic of this type of control — as it is with the Powers pneumatic system installed here.

Safety and comfort for patients is provided for throughout. For example, in hydrotherapy, in showers, in sitz baths, etc., Powers Hydroguard® thermostatic water controls prevent scalding and eliminate dangerous water temperature fluctuations.

Write for the latest Powers Hospital Catalog.

Write us also for catalog on time-saving, money-saving pneumatic tube systems manufactured by our new subsidiary, the Grover Company.



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Where are Armco Foundation Products Used?



New Sears Store, Largest in South, Stands on Armco HEL-COR Pile Shells

This is site of new retail store of Sears, Roebuck & Co. while it was under construction in Jacksonville, Florida. Now completed, it is their largest store in the South.

To support this building, more than 900 Armco Hel-Cor® Pile Shells were driven with a mechanically-expanding mandrel. Shells were supplied in 16 and 18 gage in 12½-inch diameter and driven from 16- to 40-foot depths.



Section of Armco Pile Shell



New Capitol Hill Office Building Supported by Armco Pipe Piles

The new House of Representatives Office Building now under construction in Washington, D. C., is supported by almost 86 miles of welded steel Armco Pipe Piles.

These piles are 10³4-inch O.D., with a 0.279-inch wall thickness. They were designed for a 55-ton loading and various piles were tested to 125 tons with a net settlement of from 0.250- to 0.279-inch.



Section of Armco Pipe Pile

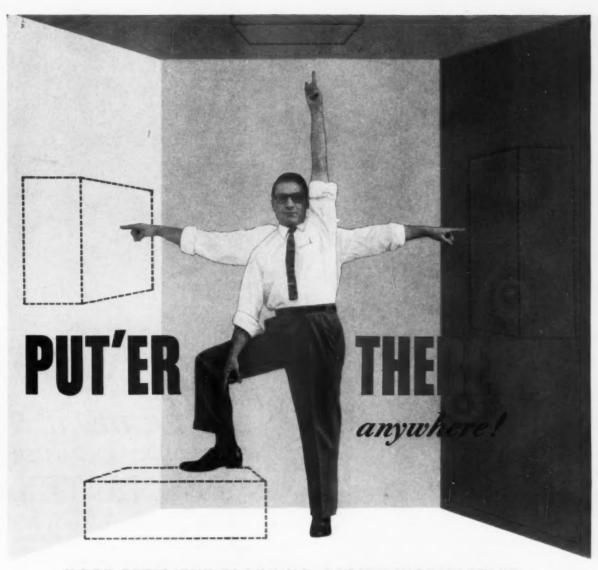


Call your Armco Sales Engineer for data on many other installations of Armco Foundation Products. Write for literature.

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MORE EFFICIENT PLANNING—EASIER INSTALLATION JEFFERSON GENERAL MOUNTING TRANSFORMERS

If space is at a premium, as it usually is in electrical closets, Jefferson dry-type *general mounting* 3-phase dry type transformers may be the answer to your installation problems. General mounting units can be installed anywhere, at any angle . . . top, bottom, any side. They are so quiet you can connect them *at the point of load*, and cut down on wire and wiring time . . . make installation easier and faster.

Jefferson general mounting three-phase transformers are available from 30KVA thru 112.5KVA.

Before you specify your next 3-phase transformer, check the Jefferson General Mounting Units.





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another BRIGHT IDEA from ENGINEERS at PENN



VENTILATION
IN ONE LOW ROOF EXHAUSTER
the PENN LITEX

Two important benefits — natural light and moving air — have now been brought together in *one* wide area, low silhouette gravity roof exhauster, the Penn Litex! Ideal for any building where inexpensive daylighting is necessary, the Litex features a new engineering concept where light is emitted through translucent fiberglass weathercaps and dampers that operate manually or automatically.

The Litex is an expansion on the design of the standard Penn Linex gravity exhauster. Air currents are moved silently and efficiently. Modular units may be used in unlimited lengths to provide continous light and ventilation for warehouses, factories, gymnasiums, etc.

Complete information and performance data, including tables of illumination are provided in Bulletin LTX-59. Write for your copy today.



VENTILATOR CO., Inc.

PHILADELPHIA 40, PENNA.

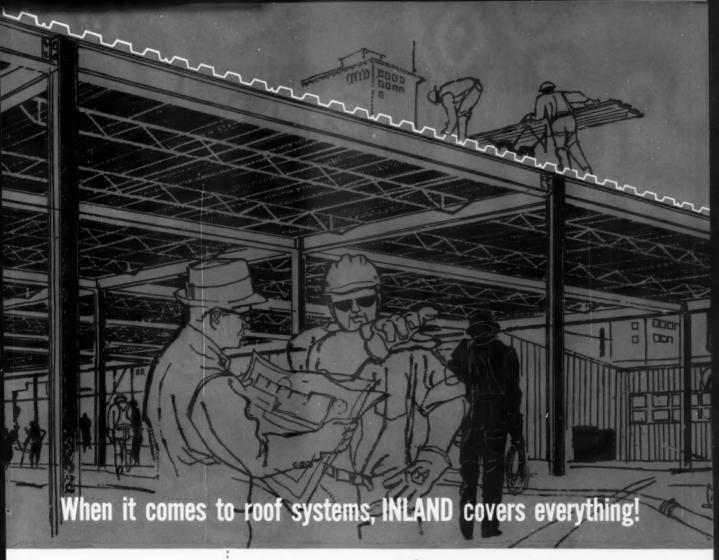
A leading manufacturer of Powered and Gravity Roof Exhausters and Accessory Equipment for over 30 years.

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Penn Ventilator products are available throughout the Free World.

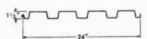
One of many direct factory representatives at your service:

R. J. Coughlin Co., Detroit, Mich.





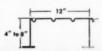
A-DECK — For purin spacings not exceeding 8'4". Narrow ribs provide deck surface that supports the thinnest or softest type of insulation.



B-DECK — For spans to 10'0". Wide rib distributes metal for greater structural efficiency — gives higher section properties per pound of steel — well suited for use as side wall panels.



C-DECK—Carries normal roof loads over spans up to 24'0". Used extensively in canopies.



T-STEEL— New! Galvanized only— for clear spans to 320°. Adaptable to acoustical and flush, luminous ceiling treatments. Provides superior diaphragm to transmit seismic and wind loads.



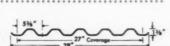
W-DECK — New! For simple spans from 10'0" to 20'0" — 3 and 442" depths. Especially practical to cover walkways in shopping centers, schools, other installations.



B-ACOUSTIDECK — Two-in-one panel combines steel roof deck with acoustical ceiling having Noise-Reduction Coefficient of .70 — used for spans to 10'0".



C-ACOUSTIDECK — Offers same Noise-Reduction Coefficient as B-Acoustideck. Can be used for spans to 24'0".



RIBFORM — High tensile galvanized steel form for concrete slabs over spans up to 8'0". Three types: Standard, Heavy-Duty, Super-Duty.

Whether your design calls for a dry insulation board roof or for wet-fill, there's an Inland roof system for the job — by the makers of famous Milcor steel building products.

Inland steel deck weighs less than half as much as poured-in-place or pre-cast construction. You can space joists wider and use lighter framework, to save both time and money. Panels are easy to handle and weld in place — in any weather that a man can work,

Types A, B, C, and H decks have the additional advantage of a Bonderized, baked-enamel prime finish that resists on-the-job damage. One field coat of paint on these Inland decks usually covers.

Write for catalogs 240, 241, and 245 — or see Sweet's sections 2c/Inl, 11a/In, and 2a/In.



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Woodcuts by Philip Reed

We have tried, since its first issue, to make Consulting Engineer a magazine worthy of the profession it serves. We have gathered the best staff we could find, equipped it with the most modern tools, and provided the finest printing and paper available. Through the years we have received many compliments from both readers and advertisers on the quality of the product, but most frequently of all we have had comments on the woodcuts that are sprinkled about each issue.

Philip Reed is one of the great masters of this art-form. His works are in the Library of Congress and in the national libraries of most foreign countries. He has twice been the subject of feature articles in *American Artist*, and *Fortune* and other publications have shown specimens of his work. The American National Exhibit in Moscow, in the summer of 1959, included his woodcuts as typical of American art at its finest; and the State Department has shown his illustrations in Central and South America and throughout Europe.

Gauguin, Millet, and numerous other painters have tried this artform, but mostly with only indifferent success. Wood-engraving is a skill not easily come by. It requires imagination and illustrative ability and, in addition, a comprehensive knowledge of printing techniques.

We know we are fortunate to have Philip Reed's wood-engravings at our disposal. We know, too, that our readers appreciate these examples of an old art, examples that complement the personality of their profession. One of Reed's most famous woodcuts is reproduced on this page, in black and white, and reduced photographically. We have printed some of the original, in six colors, on a fine paper, suitable for framing. We will send you a signed copy, if you wish.

Managing Director

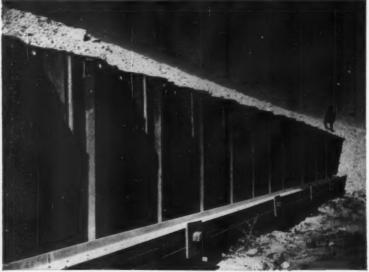
Interstate road program moves ahead in Utah

USS Highway products help pave the way...see inside



Utah's new Interstate road





There are almost 1½ million pounds of structural steel and 3,200 cubic yards of concrete in the Beck's Springs Overpass north of Salt Lake City. Design allows for expansion from four to six lanes. USS Structural Steel used here will withstand great abuse, effectively resist tension, torsion, compression and shear, and can be erected in any weather in which men can work because it's easy to rivet, weld or bolt. This bridge was fabricated and erected by the American Bridge Division of U. S. Steel.

Here USS Steel Sheet Piling is used as a retaining wall along the Salt Lake City Freeway. Nearly 44,000 square feet of steel sheet piling retain the fill next to adjacent property on the east side of the highway.

program moves ahead

USS Highway Products play a big part

Under the direction of C. Taylor Burton, Chairman of the State Road Commission, and Director of Highways Elmo R. Morgan, 965 miles of Interstate roads have been authorized in Utah. 40 miles have already been completed, 82 additional miles are now under construction. In addition, 66 of 600 planned bridges have been completed.

Highway products from U. S. Steel are playing a big part in Utah's new Interstate Road system. In the bridges, for instance, the strong USS Structural Steel being used is one of the most economical of load carrying materials. It is available for the construction of bridges of all types in a number of USS High Strength Steels as well as structural carbon steel. Other USS products include reinforcing bars in the bridges, AMERICAN Welded Wire Fabric in the roads, and high strength steels and wire rope in cranes and other machinery. For safety, U. S. Steel supplies signs, posts, guard rail and galvanized sheets for culverts.

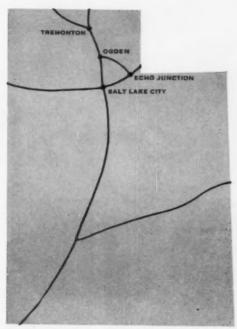
Approximately 1,600,000 cubic yards of blast furnace slag from Columbia-Geneva Steel Division of U. S. Steel will be used as embankment material on a new project recently awarded by Utah State Road Commission. Known as Interstate Highway Route 15, the project spans a 4.94-mile section where blast furnace slag will provide a stabilized embankment for the pavement and shoulder area.

USS, Di-Lok, Tiger Brand, and American are registered trademarks

Send for U.S. Steel's free 54-page booklet, "Keep Our Roads on the Go." It tells how the complete range of highway products and services available from U.S. Steel can cut costs and speed operations in every phase of highway construction. United States Steel, 525 William Penn Place, Pittsburgh 30, Pennsylvania.



The highway market also is served by the following divisions of United States Steel: American Bridge Division, Pittsburgh, Pa. • American Steel & Wire Division, Cleveland, Ohio • Columbia-Geneva Steel Division, San Francisco, Calif. • Consolidated Western Steel Division, Los Angeles, Calif. • National Tube Division, Pittsburgh, Pa. • Tennessee Coal & Iron Division, Fairfield, Alabama • Universal Atlas Cement Division, New York • United States Steel Supply Division, Steel Service Centers, Chicago, Illinois.

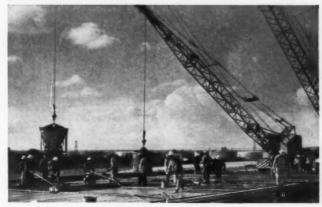


Map shows Utah's new Interstate highway network.

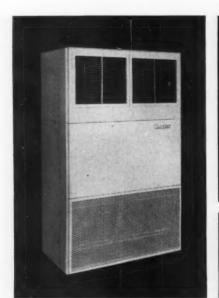


808 lineal feet of strong, long-lasting steel handrail gleam in the mountain sun on this bridge on the Davis Freeway near Bountiful, Utah. Steel products like these contribute to the safety of traffic on modern Interstate Roads.

USS Tiger Brand Wire Rope, seen here on these gigantic cranes, will lift heavy loads for a long time. The bridge is also being built to last, with the use of USS Di-Lok concrete reinforcing bars. STEEL, wherever you look—insures strong, long-lasting structures.

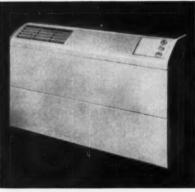


MORE NEW DEVELOPMENTS FROM CARRIER!



38R Fan and Coil Weathermakers

A complete family of fan and coil units in nine sizes from 5 to 50 tons—available both in direct expansion and water chilled models. Highly versatile, the variety of fan arrangements allows a wide range of flexibility. In many instances, this permits installations impossible with other units. These Weathermakers* satisfy the trend in commercial air conditioning for versatility and space conservation, as well as for attractive appearance.



51 Series Weathermakers

For new and existing buildings, these versatile units provide the benefits of a central air conditioning system at a fraction of the cost. An across-the-sill model is available, which ties in with central system heating through existing steam or hot water lines—or uses built-in electric resistance heat—to provide efficient and economical year-round heating and cooling. Neither unit requires remodeling or ductwork.

30HH and HJ Liquid Chilling Packages

The most compact completely packaged liquid chillers ever offered. Available in 15, 20, 25 and 30 ton models, these units represent a substantial saving to your clients in floor space as well as efficient performance. Quiet in operation, this complete Carrier refrigeration system is designed to chill water for air conditioning or industrial process cooling applications. Available with or without condensers. **Neg. U.S. Pal. Off.

Want the complete facts on these new developments? Call the Carrier dealer listed in the Yellow Pages. Or write to Carrier Air Conditioning Company, Syracuse 1, New York.





NO OTHER ANNUNCIATOR CAN OFFER SO MANY FEATURES

Now from Edwards long experience in annunciator systems, comes a completely new line of lamp annunciators incorporating outstanding operational features... developed in cooperation with consulting engineers, leading power stations, chemical process and industrial plants. Design and operational flexibility is keyed to present and future demands of automatic process control and all types of automated systems. Edwards technical specialists in 58 cities across the country can show you how Edwards lamp annunciator systems can provide the most reliable flexible operation for every type of indication. Write for your copy of a new descriptive Bulletin A-200. Edwards Company, Inc., Norwalk, Conn.

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As he remarked in his last speech as EJC president, "Utopia to one man is but myopia to another.

"The whole idea of a single, unified professional engineering organization is unnatural. There are, it is true, a dozen or more important national engineering groups, but each group was organized to fill an existing need. We must assume that the need still exists if the group does. Some engineering organizations are better than others, of course, but every national organization must justify its existence. While there are natural reasons for these organizations to join together on matters of common interest and common activity, they will remain together only so long as they consider it appropriate and helpful to do so. None of them is likely to have much enthusiasm for giving up any of its basic activities, turning these over to some supergroup. Some engineers are prone to find a formula for everything, but unity cannot be brought about by demand of a board of directors.

"The old American Engineering Council was a fine idea, organized with highest aims. Then the men in charge began to think in terms of a superorganization responsible only to themselves. As a result, they failed to maintain the support of their member societies.

"When Engineers Joint Council first was organized, it had some of the same faults of the old American Engineering Council. Out of these initial trials and troubles, a workable organization slowly evolved. This organization was built on the idea of providing a common meeting place for all engineering societies, for common discussion and eventual action on problems of common interest. This is the type of unity group that works. Each EJC constituent joined of its own free will and remains an EJC member only as long as it is beneficial to do so.

"What would happen if our societies tried to organize under the so-called Functional Plan, and a national problem arose affecting, for example, only the civil engineers? Nobody is going to tell the civil engineers how they can handle this problem. The same would be true of the electricals, mechanicals, chemicals, miners, and all other such groups with special interests. A vital problem requires vital attention of those affected; they cannot assign the problem to others. Whenever a fellow is about to propose to a girl he usually figures he can do that job himself better than anyone else."

Attitude on Public Works

Needles, whose firm has handled more than \$1 billion in highway and bridge design, has an un-

common attitude toward the use of consulting engineers on public works.

"I have never assumed consultants have any inherent right to government business. We are called in by government agencies when we have something to offer that is essential to a particular project. Our present great national system of highways — their planning, design, construction, and maintenance — all came through our state and Federal highway organizations started 40 or more years ago. On the other hand, we have an important group of toll roads designed for the most part by consulting engineers during the past 15 years or so. Financial conditions influenced the development of these procedures.

"Now that the Interstate Highway Program has gotten under way, consulting engineers are needed mostly on projects such as bridges, complicated intersections, and urban expressways. If the project is routine and does not involve urgency, lack of state personnel, or a rather unusual engineering problem, then the job is no place for consultants.

"Consulting engineers should realize their greatest allies are the better qualified public officials. Antagonism of these men is not the proper approach to increased work for consultants."

Views on Engineering Societies

Although he is not now heading any engineering society, Needles still maintains an active interest as a member of many organizations. He looks upon the new United Engineering Center as evidence of one of the finest displays of professional cooperation in the history of engineering societies. He considers United Engineering Trustees, Engineers Council for Professional Development, and Engineers Joint Council as strongest possible examples of "unity in fact" — permanent organizations built upon true cooperative effort among the major engineering societies. Asked to comment on the various other technical and professional organizations, he said:

American Society of Civil Engineers recently passed a fine statement on the use of consulting engineers on public projects. I approved of taking out the amendments, which in my estimation were too strongly in favor of consulting engineers to come from a group like ASCE. As an organization with its greatest strength in the technical field, and with members of all types (employee and employer, in both public and private service), ASCE must represent all of its members, and it is not representing the full membership by taking sides in a nontechnical controversy.

"Engineers Joint Council is in much the same position as ASCE. As a group with widely diversified constituent membership, EJC should let each

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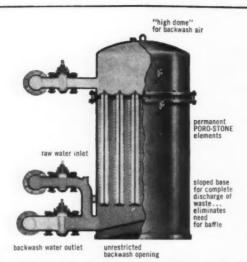
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society fight its own battles peculiar to the individual society.

"American Institute of Consulting Engineers can express righteous indignation at anything threatening the consulting profession. This is strictly a group of consulting engineers, with their own particular interests and points of view.

"Consulting Engineers Council presented some good testimony on behalf of consultants in Washington recently. I have considered joining the Council, but I cannot see the advantage in joining the local New York City Association, which represents principally engineers in the buildings field. I would be happy to pay the national dues, however, and I may join the Council.

"American Road Builders Association Engineering Division has developed well during the past four or five years. I think ARBA, which speaks for contractors, manufacturers, material suppliers, public officials, and consulting engineers, has great strength in Washington. Congress frequently asks ARBA for information. ARBA data are not slanted in favor of any special group or interest.

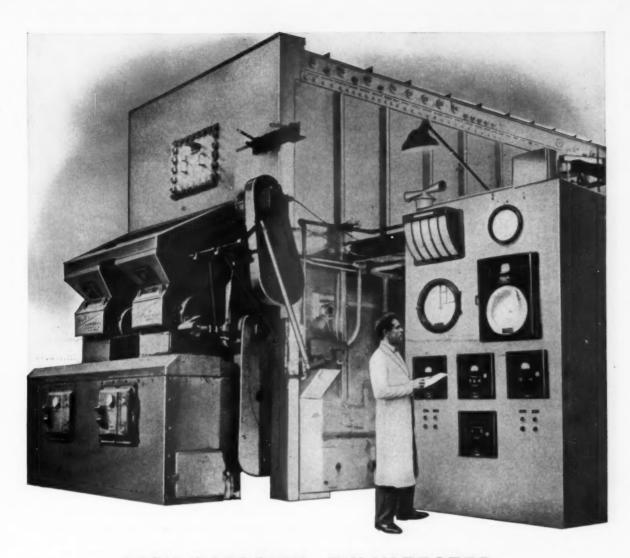
"National Society of Professional Engineers is, of course, the coordinating body for its affiliates. I have highest respect for, and appreciation of, the purposes and services of these different state societies which represent our registered engineers, and it is only natural and logical that these state societies should be banded together through NSPE. I have been a registered engineer for 40 years, and a state society member since the movement started.

"Automotive Safety Foundation can work best in the areas for which it was designed. It was created originally because everyone is against sin and in favor of safety. So far as I can see, the Safety Foundation does not need to go beyond the field of safety to keep fully occupied."

Professional Background

Needles, who is an energetic 71, was born in Brookfield, Missouri, next to the youngest of nine children of a farmer. When he was 12, the family moved to Kansas City, and Needles was enrolled in a classical high school. Here he gained an interest in engineering through a professor, who frequently took him along on field survey work. He remembers the high school for another reason. The school was baseball conscious, and Needles played center field occasionally. One of his teammates (Casey Stengel) was a better player, Needles confesses.

At the time Needles was graduated from high school, going to college was rather unusual for the average boy or girl, especially when finances were limited. So for three years after high school and during the summers of his college years, Needles



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worked for the Kansas City Park Department, working with a group having the assignment of surveying 75 percent of the city's present park and boulevard system.

In 1909, Needles enrolled in the University of Missouri School of Mines and Metallurgy, in Rolla, Missouri. When he got his degree, in 1914, a depression hit and he worked for over a year at parttime jobs in field and mine surveying, mine drafting, and railroad evaluation work for the Kansas City Southern Railroad. The next year, he got a job in the track department of the Kansas City Terminal Railroad, and a year later was transferred to the bridge department.

During this period, Needles did his share of traveling. "I guess the worst assignment was Louisiana. I caught malaria and had to have shots every two weeks for a long time. The malaria bothered me off and on for several years."

Enters Consulting Field

In 1917 he took a "temporary" job with the forerunners of his present firm, Harrington, Howard, and Ash. Since he had been hired for three months, he asked at the end of this time what he was to do. "Has anybody said anything about your leaving? Keep working," he was told. He is still working for the same company.

The firm was active in the field of bridge engineering under the name of Harrington, Howard and Ash from 1914 to 1928; then as Ash, Howard, Needles, and Tammen from 1928 to 1940. It has been Howard, Needles, Tammen and Bergendoff since 1940.

Soon Needles was busy on the design and supervision of bridges for the consulting firm. Among his early projects was the bridge across the Red River, at Texarkana, Texas. In 1919 he went to Jacksonville, Florida, where he stayed for three years as resident engineer on the St. Johns River Bridge, the first highway bridge to replace a ferry across the river at this location. The bridge served all of the East Coast of Florida.

After this project, Harrington, Howard, and Ash sent Needles on an assignment in New York City, and for some time he "worked out of his hat," traveling throughout the East. Again, a temporary assignment became a permanent one, for he has worked in New York City since then.

The firm got the Chesapeake & Delaware Canal project, and since Needles was closest he had the task of doing the surveying, supervising the borings, and gathering other field data for designing bridges — low level with movable spans. The project for five bridges amounted to \$1½ million, and Needles commented that today just one bridge over the present canal (wider and deeper than the original)



Architects and Engineers:

02

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would cost several times that. "Although most of those bridges have been replaced by now, a ship ran into the last one, and we have just finished the repair plans," he commented.

Later that year (1922), Needles brought his family – temporarily – to Elizabeth, New Jersey. He lived there and in Summit until recently, when he and his wife had a new home built at New Vernon, New Jersey, right in the middle of what is likely to become the Morris County jetport serving New York City. "With me living in the middle of a proposed runway, it does not sound like I have much inside political knowledge, does it?"

Needles, who did not know too many people in his early New York City days, became immediately active in ASCE. One of the men he met through ASCE work was E. A. Bryne, chief engineer of New York City's Department of Plans and Structures. Needles frequently stopped by Bryne's office to chat - "about ASCE and generalities, not bridges." Mr. Bryne's favorite project at the time was his idea for a new Harlem River lift span at 125th Street. A few years later, the Triborough Bridge Authority was formed, and Bryne was made the chief engineer. As the depression was slowing down in 1933, official plans were announced for a Harlem River lift span, connecting Manhattan, Queens, and the Bronx. Needles got the job, moved his office to the Port Authority Building, and was kept busy throughout the rest of the depression years.

Before long, Needles' firm — by now Ash, Howard, Needles & Tammen, had been given several bridge design projects for the Public Works Authority and the Reconstruction Finance Corporation. These public organizations tended to have more projects than money, so Needles spent a lot of time in Washington following papers through the various offices while waiting for the money to materialize. His efforts paid off. In 1937, when more Federal funds were allocated, Ash, Howard, Needles & Tammen got seven bridges up for approval. When the new approvals were announced, all seven were included with special mention of four which were to go forward immediately. This

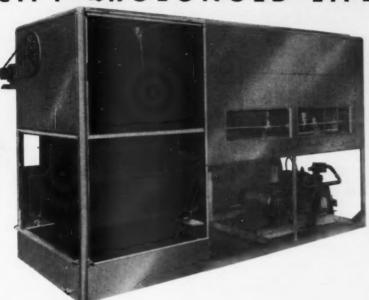
kept the firm busy until 1940.

World War II Service

When war came, Needles was asked to organize the Construction Quartermaster Corps zone office, in New York City, and he took a leave of absence from his firm to do so. Three months later, just as this project was getting under control, Needles received a call at home one Saturday night asking him to be in Washington early Monday morning. They wanted him to resign from the zone office so he could represent his firm as resident partner

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on the Southwestern Proving Grounds, at Hope, Arkansas. "This was to be an ammunition testing ground and a major airport. We chose the site, and it was July 4th, 1941 when we set up offices in the high school. We finished that winter."

Next his firm was given the rush project of building the Bluebonnet Ordnance Plant, in early 1942, near McGregor, Texas. "We were given one year and a budget of \$30 million for the project. Six weeks later, we were told to hurry - finish in six months if possible. By keeping work going night and day, we made it and came out \$8 million under the budget."

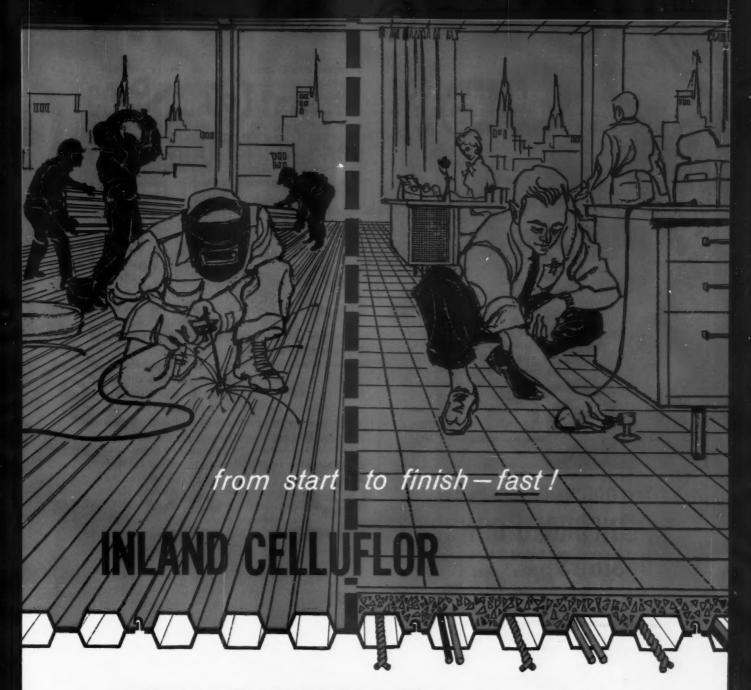
Needles was back home in Summit when he received another Saturday night call. The next Thursday - a Thanksgiving Day - he reported to New York City for a physical. Entering the Corps of Engineers as a Lieutenant Colonel, he was promoted to a full Colonel in 1944. For his work on redistribution of construction equipment and materials while in the Corps of Engineers office in Washington, he received the Legion of Merit.

Postwar Projects

One of the first projects Needles got after the War was the design of the Delaware Memorial Bridge. This \$55 million project was to be a sixlane highway bridge, more than 10,000 feet between abutments. After Needles' firm had completed the design and it was ready for bidding, he was told the project was to be cancelled because of a lack of funds. "By then, the Delaware Highway Department owed us \$400,000. In desperation, we worked over the plans to show a fourlane bridge, cooperating with the prospective contractors to bring the bridge within available funds. When they paid us, Warren Mack, of the Bridge Commission, commented that he got more satisfaction out of writing this check than any he ever had written." Since then, Needles' firm has handled many of the largest bridge and turnpike projects in the country.

"Because of our experience designing toll bridges and extensive approaches long before anyone thought of toll highways, we were called in as general consultants (first on the Maine Turnpike) with the responsibility of making preliminary studies; reports for financing; designs and plans; supervising construction; and advising on problems of operation and maintenance on many of the larger turnpikes."

Among the states in which this firm has had turnpike projects of varying size and responsibility are Maine, New Jersey, Ohio, Kentucky, West Virginia, Florida, Kansas, Colorado, Texas, and Massachusetts. "We now are serving as general consultants on an extension of the Massachusetts



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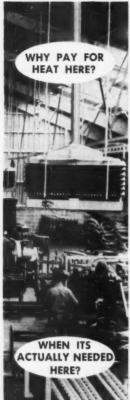


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Turnpike into Boston" he added. This project will require a \$180 million bond issue.

Howard, Needles, Tammen & Bergendoff also has handled bridge projects of every type — long span, short span, and movable — for clients in 40 states and in Canada. There have been bridges over the Mississippi River at Natchez, Greenville, Vicksburg, Cape Girardeau, Alton, and Rock Island. As a part of their work on the New Jersey Turnpike, they also designed the Hackensack River and Newark Bay bridges.

Firm Policies

Needles and his partners operate the firm in such a way that all projects are "our" projects. As Needles explained it, "there is no such thing as a one-man job. One man trying to take all the credit smacks of a man with an inferiority complex and the feeling that there is not enough credit on the project to share with others. We have had jobs big enough for all to be proud."

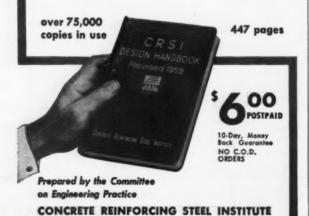
Needles would like to give varied experience to his men, but this creates a problem. "It is difficult to send a man from the office to the field. His salary must be less in the field to conform with his experience, or it puts the entire field staff at too high a pay rate. This field experience is priceless. Yet the office man knows that life goes on, and promotions are made while he is gone from the office. He may be losing some ground. It is also difficult to take a good field man and put him in the office. He is like a fish out of water."

Always an ardent civil engineer, Needles recently was asked to dedicate a new civil engineering building at his alma mater, the Missouri School of Mines and Metallurgy. Speaking to the young civil engineers, Needles said:

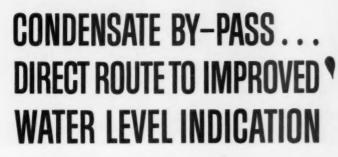
Today, what are the problems before the civil engineer? He is being called upon to provide water supplies for communities so far beyond anything originally contemplated that the new demands can scarcely be recognized by the previous standards. Available water supplies are decreasing just as rapidly as the demands are increasing. The disposal of community wastes is equally challenging, without reference to the very serious need for disposing of nuclear wastes. What structures must accompany nuclear fission and give protection against nuclear blast and fallout? What new materials and equipment can be utilized in the design and building of our structures? How are we to plan our cities and transport materials and people to them and within them? In many ways, the new problems are more complicated than the original problems. If we assume we already know the answers to all such questions, we are being false to the trust which is ours as professional men."

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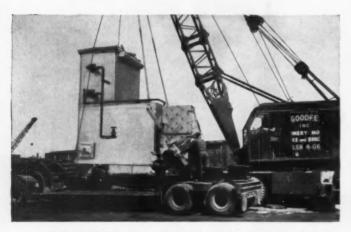




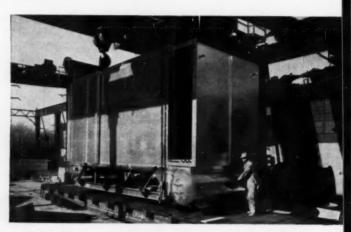
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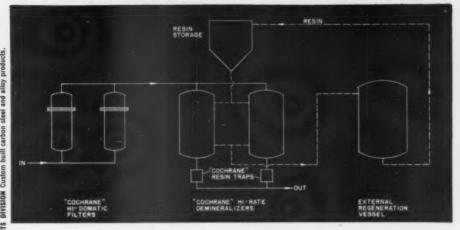


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Government Utility	Alabama	2400	2,450,000	
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The famous LOCHMOOR CLUB of Detroit now uses the same TOTAL WATTAGE as before to get TWICE as much light



DOWN LIGHT-TOO CONCENTRATED

Low-brightness on the *object* you are looking at No brightness on the *vertical* surfaces



KIRLIN-WIDE SPREAD-GLARE-FREE

All objects to be seen are well lighted Wide distribution lights the vertical surfaces

No "Hot Spot" with Kirlin Lenses



LAFAYETTE (IND.) SUPER MARKET

Down lights are intended for spot lighting not for area lighting—Bascart in foreground is hardly distinguishable





FORT LAUDERDALE AIRPORT

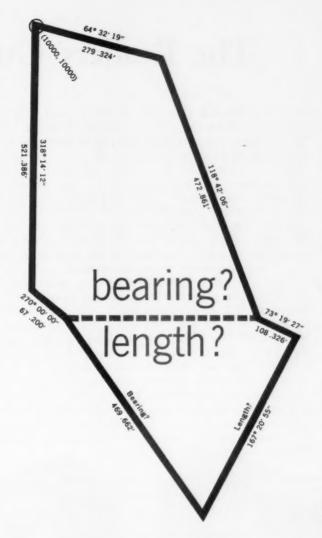
Kirlin wide angle lenses light both vertical and horizontal surfaces.

Note how car in background stands out

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Low-cost IBM 1620 Computer frees your engineering staff for more creative work

The low-cost IBM 1620 Engineering Computer solves the traverse problem automatically, in seconds. It also balances the traverse if misclosure is within tolerance. It computes the area within the closed traverse. Versatile and fast, the 1620 can solve interdependent traverse and triangulation problems and many others not directly associated with surveys.

The time saved by the low-cost 1620 in computations like these enables your engineers to spend more time utilizing the

results of surveys and less time reducing raw data to usable form.

A readily adaptable survey analysis program has been developed by IBM and will be available without cost later this year. This is another example of Balanced Data Processing, machines supported by a complete range of services. Ask your IBM representative about the advantages of the 1620 and how they can be put to use in your operation. Like all IBM Data Processing equipment, the 1620 may be purchased or leased.



The IBM 1620 is a low-cost, desk-size engineering computer with features previously found only in larger systems. It offers solid state design, magnetic core storage and high-speed internal computing performance. Its versatility and ease of operation recommend it for such engineering applications as highway cut-and-fill calculation, bridge design analysis, earthwork design and many others.

BALANCED DATA PROCESSING







Later Day
"Gardy Loo"
(page 103)

The Readers' Guide

There is considerable justification for the frequent complaints of engineers and government officials that there is nothing new in sewage treatment. Technical progress has not been startling in the past 25 years or so, and except for a refinement here and a new instrument or control there, an operator of the '20s could take over a plant of the '50s and run it after just a few minutes instruction. If there has been more startling advance in rocketry than in filtration; more effort devoted to electronics than to effluent treatment; this is not to say that sanitary engineering is at a standstill. The mere fact that the wastes of an expanding population are being handled without disastrous epidemics of typhoid, cholera, and other pollution-related diseases, indicates that our sanitary systems are functioning effectively even if they are not of space-age design. If we are, from time to time, discouraged by an apparent stagnation of the art, it is encouraging to look backward a bit. The engraving from a painting by Hogarth used as the title page of this month's Special Report on "Sewage Treatment" was made only 200 years ago. It shows a chamber pot being dumped from a second story window into the street below, the pedestrians being warned only by the cry of "Gardy Loo." This is shocking enough for mid-18th Century London, but this same picture, with only the costumes brought up to date, could have been Paris a hundred years later. Railroads were running on fast schedules across Europe when the gutters of her greatest cities were still open sewers . . . Cholera was a familiar spectre. We have made progress, and in this Special Report the reader will be able to get some idea of the current state of sanitary engineering. The problem of the huge city and the small suburb, treatment plants or lagoons, custom design or package plants, new equipment and promising chemicals - all these are discussed in this Report.

No one will deny that some engineers are technically superior to others, but it usually is not technical ability that makes or breaks a private practice. Most successful and growing consulting engineers are headed in that upward direction because of their business acumen rather than some unique technical proficiency. It is a simple fact that the finest engineer in the world can offer nothing to his clients if he fails as a businessman. And many — perhaps most — failures result from an ignorance of costs. All too often an engineering firm is losing money on a project without knowing it. It is essential that accurate cost records be kept and used. Loss conditions must be recognized before they occur. This is the topic of Dick Tatlow's article in this issue. Tatlow is well qualified to write on this subject for his firm, Abbott, Merkt & Company, Inc., is a successful operation with a sound financial history. Tatlow lectured on this general topic at the University of Wisconsin Institute for Consulting Engineers, this past spring, and his presentation was well received. No one system perfectly fits any two firms, but the Abbott, Merkt methods are worth the study of every consulting engineer.

You Can Be A Profit Prophet

(page 98)

Finch's Story of Engineering

(pages 142 & 188)

James Kip Finch is in this issue not only with another of his series on The Great Books of Engineering (Rathborne's *The Surveyor*), but also in a book review. Dean Finch has just had his new book, *The Story of Engineering*, published. Doubleday and Co. have brought it out in an inexpensive edition for only \$1.45. Our reviewer feels that the work deserves hard covers and better paper, but this inexpensive, paperback form has the advantage of being priced for students rather than for engineers. We hope that his series on the *Great Books of Engineering* will someday be available in book form, too.

EH G g JKTJ TJK eh K F jk LM NF tef
NE NM TEF KL TKL LM EH TJ jk l EH k
K EH G JK TJK JK TEF NF Mm TKL eh
F JK LM NF Mm tef EH JKL G eh JK TJ
K EH tjk JK NF LM F G TJK Mm KL nm
TJK JKL TJ G jk TKL NJ KL JK EH tjk



in specifying AB breakers the reign of confusion is over



Westinghouse completely redesigns its breaker line

SIMPLE TO SPECIFY EASY TO IDENTIFY

Newly designed breaker line simplifies frame designations . . . reduces space requirement up to 50%. Because of recent Westinghouse engineering advances, these new breakers retain the same high interrupting capacities of older designs in smaller frame sizes. The new designs mean it's easier for you to order, install and use AB breakers. Gone is the confusing assortment of letters that designate other models. These new breakers are easy to identify because they follow a common-sense sequence. They're simple to specify because you choose from only six breakers for virtually every application. They're better to use because they're smaller . . . yet you have the same quality and reliability of the former Westinghouse models you've been using.



15-100 amps, 240 volts a-c, 125 volts d-c, 1, 2 and 3 poles IR @ 240 volts a-c: 7500 amps



15-100 amps, 600 volts a-c, 250 volts d-c, 2 and 3 poles IR @ 240 volts a-c: 20,000 amps Replaces: EH, F and G breakers Check Westinghouse for availability of this newest breaker.



70-225 amps, 600 volts a-c, 250 volts d-c, 2 and 3 poles IR @ 240 volts a-c: 25,000 amps Replaces: J breakers



70-225 amps, 600 volts a-c, 250 volts d-c, 2 and 3 poles IR @ 240 volts a-c: 30,000 ampr Interchangeable Trip Replaces: JK and K breakers



125-400 amps, 600 volts a-c, 250 volts d-c, 2 and 3 poles IR @ 240 volts a-c: 50,000 amps Interchangeable Trip Replaces: KL and JKL breakers



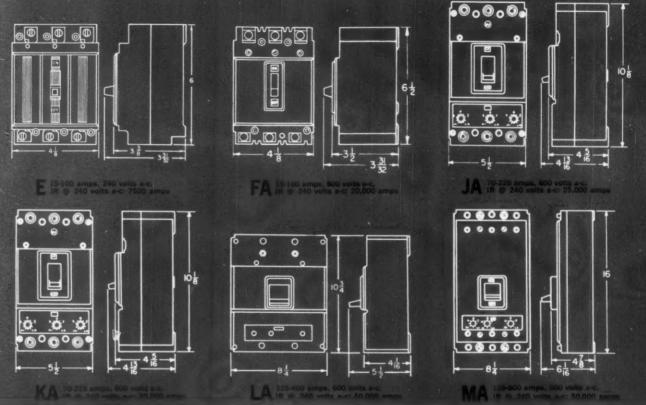
125-800 amps, 600 volts e-c, 250 volts d-c, 2 and 3 poles IR @ 240 volts a-c: 50,000 amps Interchangeable Trip Replaces: L, M and LM breakers

IR=Interrupting Rating

• Add the fact that terminals accept either copper or aluminum cable. Any way you look at it, the **NEW** Westinghouse line is the one you'll want to use from now on. • Want more information on this new line of breakers? Contact your Westinghouse representative, Westinghouse distributor, nearest independent panelboard-switchboard builder, or write Westinghouse Electric Corporation, Standard Control Division, Beaver, Pa. • We're offering a free wall chart that shows the new line of breakers. It measures 17 x 22 inches, is plastic coated and gives dimensions, interrupting ratings, maximum amps and volts and, of course, the newest designations along with the breaker photos. Write to the Westinghouse address above for your copy.

All Westinghouse AB breakers meet or exceed NEMA and UL specifications.

new breakers / new sizes / new designations



IR = Interrupting Rating

a Westinghouse breaker for every application





SAF-T-VUE* . . . lets you see whether the contacts are open or closed. Fills the needs of every industrial plant where safety codes require visible contacts. All frames.



MARK 75* . . . interrupts up to 75,000 amps at 240 volts a-c. Costs a fraction of conventional high interrupting capacity breakers. Does not require reactors or fuses, is particularly suited for network systems.



TRI-PAC* . . . smallest, lowest cost protective device you can apply where 100,000 amps can be poured into faults. Example: network systems or those fed by large transformers.



THERMAL MAGNETIC ... provides instantaneous opening on short circuits, yet permits harmless momentary overloads such as those encountered in motor starting and initial lighting surges. On sustained overload, the higher the current, the shorter the opening time. All frames.



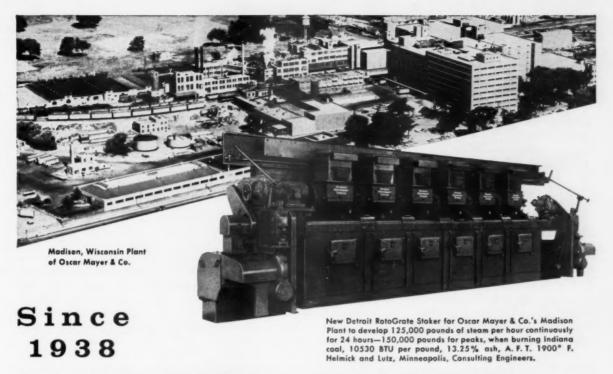
AMBIENT COMPENSATED . . . ends nuisance tripping, and eliminates need for derating where elevated or changing temperatures are encountered. All frames.



MAGNETIC ONLY...provides short circuit protection only. Primarily used on motor circuits where overload protection is provided by other means. All frame sizes except E.

WESTINGHOUSE ELECTRIC CORPORATION Standard Control Division, Beaver, Pa.

*Trade-Marks



Detroit Stokers have served Famous Sausage Makers with <u>Economy</u>... <u>High Availability...Low Maintenance</u>

Oscar Mayer & Co., pioneer meat processing firm, has been making sausages since 1883. By stressing quality and uniformity of product, it has grown from a small meat market on the near-north side of Chicago to the nation's 9th largest producer with sales last year of \$260,000,000.

In 1938, the company installed a Detroit RotoStoker in the Madison, Wisconsin, plant. Purchase of a plant in Davenport, lowa, brought them another RotoStoker in 1941.

These served so well that in 1947, they bought a Detroit RotoGrate Stoker for the Madison plant as a part of an expansion program.

When more expansion was planned in 1959, they bought two more RotoGrates, one each for the Madison and Davenport plants, making a total of five acquired since 1938.

Detroit RotoGrate is an overthrow spreader stoker with traveling grates that move slowly forward, discharging ash at the front. Suitable for boilers up to 400,000 pounds of steam per hour capacity . . . it burns any bituminous coal or lignite and many types of refuse, separately or in combination with coal. It is one of the complete line of Detroit Stokers for small, medium and large boilers.

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STOKERS

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Write Your Congressmen

I was much impressed by your excellent editorial in the June issue in which you so clearly pointed out that the question of the use of private or government engineers on public works is not so much a matter of competitive price as it is a matter of economic principle.

Your editorial inspired me to write to each of my Congressmen encouraging them to support private practice on public works as a matter of principle rather than on the basis of comparative cost—though I, like other consulting engineers, am certain that the cost of design and supervision when done by consulting engineers is considerably less than the cost of approximately similar work done by government employee engineers.

I quote here from my letter to each of the Massachusetts Congressmen, with the thought that this may encourage consulting engineers in other parts of the country to write to their Congressmen, too.

In writing to my Senators and Representatives, I said:

The Massachusetts Association of Consulting Engineers is a voluntary organization composed of consulting engineers in private practice within the Commonwealth of Massachusetts. As segments of the private enterprise system, we note with considerable alarm the constant encroachment of the Fed-

Readers' Comment

eral government in the field of consulting engineering.

"This has been brought to our attention forcibly by the General Accounting Office and its instructions to the Bureau of Public Roads that the use of consulting engineers on the Federal Highway Program is not in the best interests of the government.

"As far as we know, no adequate cost accounting systems have been set up by any government agency, so that attempts to state whether or not the use of consulting engineers is more or less costly than doing the same work by government engineers cannot be meaningful. However, we feel strongly that this is not a matter of price but is rather a matter of principle. We feel that the private practice of engineering, or any other private enterprise, should not be subject to price competition by government activity.

"We strongly request your support for this view in any bills that may come before Congress."

It was this letter that I sent to Senators John Kennedy and Leverett Saltonstall as well as to the fourteen Representatives from Massachusetts.

Hugh P. Duffill
President
Massachusetts Association of
Consulting Engineers
Boston, Massachusetts

Photogrammetry as a Profession

The photogrammetry profession is a small but highly specialized segment of the civil engineering profession. But its work—and the quality of its output—is of vital importance to the construction industry. As you well know, before any sizable construction project can get under way, the area must be surveyed and mapped. Within

recent years, production of maps from precise aerial photographs has been generally accepted, and some dramatic savings in time and costs have been realized by this engineering method.

The great bulk of the mapping required to get Interstate highway projects under construction has been accomplished by private photogrammetrists. Their services have been in demand, also, by engineers engaged in designing large dam and other construction projects, and by municipal and county officials desirous of undertaking public works improvement programs.

Some states have heretofore required that such services be sought through competitive bidding, and some photogrammetry firms have complied. However, for several years, the American Society of Civil Engineers has been attempting to determine if photogrammetric mapping is properly classifiable as a professional civil engineering activity. ASCE decided recently, after considerable study, that this is the case. One practical result is that the civil engineering profession will be asked to negotiate for such services in the future, and civil engineers engaged in photogrammetric mapping will be asked to refrain from bidding competitively for this type of work.

The questions of whether or not to "go professional" have all been thoroughly debated. Both photogrammetrists and civil engineers are in agreement. The immediate problem is one of switching over from one method of doing business to another. It cannot be too gradual a transition without doing injury to some photogrammetry firms and without endangering the professional standing of civil engineers in awarding agencies. The solution is to seek the widest possible pub-

... the most unusual curtain wall

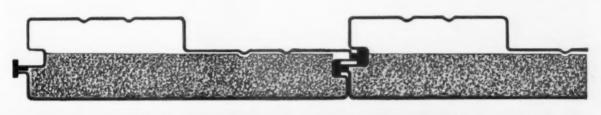
MONOPANL

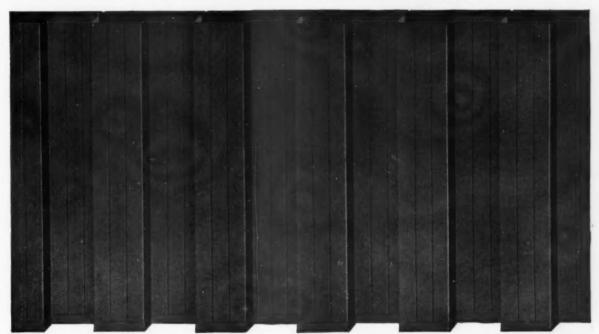
A factory-assembled wall panel in one foot modules . . . one that is self-sealing for life by mere installation. You never caulk it. And there are no visible outside joints or fasteners to mar the surface. This is Butler Monopanl, the most unusual curtain wall. Tongue-and-groove joints with double vinyl gaskets provide the seal. The cross section sketch tells the story.

Spanning ability is exceptional, as you can see from the configuration. Glass fiber insulation will not settle.

Beautiful Monopanl is furnished in a range of gauges. Exterior and interior faces can be specified in aluminum or galvanized steel. Choose from a selection of factory-applied colors. Integral fenestration is available.

For further information refer to Sweet's 1960 Architectural File. For complete technical details and actual samples of Monopanl, contact your Butler Builder He's listed in the Yellow Pages under "Buildings" or "Steel Buildings." Or write direct for a descriptive brochure and data sheets.





"See Sweet's Industrial or Architectural File-Section 8-B"





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licity of this new position and so attempt to avoid any chance of misunderstanding.

Col. John G. Ladd Executive Secretary Association of Professional Photogrammetrists Washington, D. C.

Chance to Exchange Views

I have a brother-in-law in Spiez, Switzerland who reads Consulting Engineer each month. He wrote me that he would like to get in touch with some of your American consulting engineer readers – particularly structural engineers who are interested in the same specialty that he is – cable transports, aerial tramways, ski lifts, and this type of structure. He is hopeful that your "Readers' Comment" column may lead to some contact with his American colleagues.

My brother-in-law's name is Albert Schoenholzer and his office is at 2 Hofstettenstrasse, Thun, Switzerland. He is a graduate of ETH/SIA and a member of the Association Suisse des Ingenieurs-Conseils, which in turn is a part of the International Federation of Consulting Engineers. I understand that this indirectly relates him with the Consulting Engineers Council in the United States. He speaks and writes German and French fluently and understands English but would not be able to write in English. I would be happy to handle the translation for him.

Therefore, if there are any American consulting engineers interested in this particular field of structural design, I would appreciate their writing to Ing. Schoenholzer, and sending their letters to my address. I will translate and pass them along to him.

Mrs. Harry H. Sturzenegger 613 Church Street Endicott, New York

Engineering Ethics

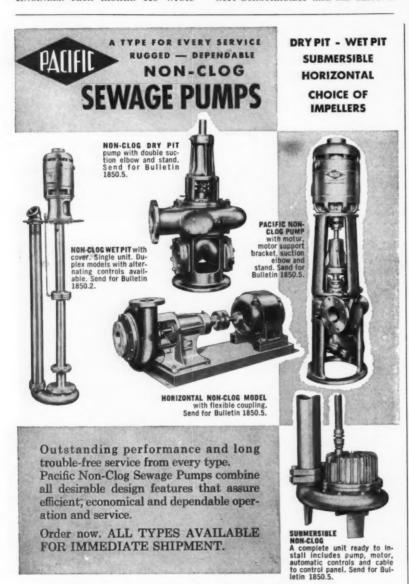
Your article "The Search for a Single Code" which appeared in a recent issue of Consulting Engineer, contained such a complete and concise history of Engineering Societies that I should like to have a copy of it for future reference.

Very often, engineers and laymen alike are incognizant of the devious growth of the Engineering Societies. The information in your article will dispel the lack of knowledge in this area.

> Stanley S. Paist, Chairman Ethics & Practice Committee Pennsylvania Society of Professional Engineers Harrisburg, Pennsylvania

Strictly a Specialist

I would like to compliment your managing director, Mr. R. W. Roe, on his "A Portrait of the Profession," particularly his statement "What an engineer calls himself is of little importance . . . What is important is what he can do." However I question seriously his use of the word "few" in the statement





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WHEATLAND TUBE COMPANY

MILLS: Wheatland, Pa. + Delair, N. J.

"Few engineers end up in those branches of engineering so boldly printed on their diplomas."

The Editor's "Tranquil Tower" is timely in pointing out the ridiculousness of the District of Columbias' voluminous restrictions on technical specialties; however he is misleading in his further discussion of the subject.

One does rarely find a project that is, in its entirety, mechanical, electrical, or structural, but to say that "Technical segregation is to be discouraged" is truly naive . . .

I received a B.S. degree in electrical engineering, have worked for Federal, state, and municipal governments; private industry; and engineering firms. I also have been a teaching faculty member in two Universities, teaching in two branches of engineering. I have worked in the field of engineering for 32 years and have practiced in the field of engineering for over 20

years, including most of the 48 original states and two foreign countries . .

I studied and worked in the field of Industrial Engineering for 10 years before I added the "title" of Industrial Engineer to that of Electrical Engineer and then only after some soul searching.

I have taught the two survey courses in electrical engineering to the nonelectrical engineering students in two different Universities.

Now the graduates of the future in engineering may be qualified to call themselves just "Engineers" without adding the "branch," but few of we "old fogies" (I am 48) can ever do so.

The medical profession has its specialists, and the fields of specialization are additive rather than restrictive, yes — but they receive a degree in medicine before they study to become a specialist. Mr. Editor the engineer does not . . .

Please, may we continue to have imaginative editorials, but document your information. You are not writing a newspaper you know.

W. W. Zook, P.E. Consulting Electrical Engineer Wichita, Kansas

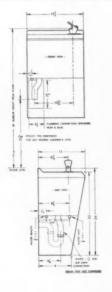
Mush, Boys, Mush!

I note on page 195 of the July Consulting Engineer that Carrier is claiming a Milwaukee installation as the "northernmost heat pump." Unless my map is in error, a York installation at Minneapolis is not only further north but is, to our best knowledge, still the largest heat pump installation in the country. Our Sylvania installation, near Rochester, New York, is also pretty far north.

Until we have better sources of reference, perhaps all of us in the air conditioning industry should be more prudent in our use of "first," "biggest," "most," and other similar superlatives.

Ben L. Williams York Division Borg-Warner Corporation York, Pennsylvania

Haws Model HWT-13





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HAWS brilliant new wall mounted electric water coolers are a clean break with tradition! Compact design hugs the wall — leaving floor area clear! Crisp, clean styling is crowned by gleaming stainless steel — with plumbing and electrical unit completely enclosed. HAWS "clears the deck" for uncluttered maintenance ease and shining clean floors. This innovation in water cooler concept and design scores a clean sweep for HAWS — leader in the field since 1909! Find out about HAWS' complete line of drinking facilities. See HAWS Catalog in Sweet's Architectural File or write for your copy today.



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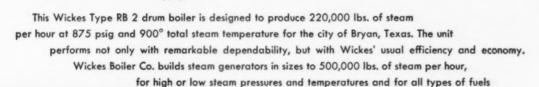
WRITE FOR DATA ON HAWS CAFETERIA AND RESTAURANT WATER COOLERS

NEW WICKES STEAM GENERATOR

insures maximum efficiency and dependability for BRYAN, TEXAS, MUNICIPAL POWER PLANT

Caivin W. Beard, Superintendent of the Electric Utilities of Bryan, Texas, Municipal Systems "As in every other power plant, our steam generator must give completely dependable performance day in and day or





and firing methods. See your nearest Wickes representative for full information on a Wickes steam generator designed to suit your needs.



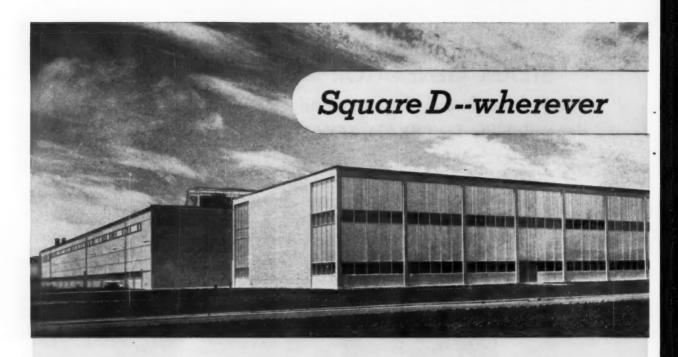
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Largest of its kind ever built!..

LOCATED ON A 474-ACRE TRACT AT HINSDALE, ILLINOIS, the new International Harvester Farm Equipment Research and Engineering Center is the largest facility of its kind ever constructed. It houses under one roof nearly all of the people responsible for creating, designing and testing Harvester's farm and industrial tractors and farm implements.

As styled by Raymond Loewy Associates, the huge center is virtually self-sufficient. It provides complete dispensary, cafeteria and fire-fighting facilities. Water is supplied by onthe-site wells. The electrical capacity equals 60% of the maximum load of the entire village of Hinsdale, with a population of 12,000! Part of that load is consumed by an air-conditioning system which cools the equivalent of 700 average homes.

Square D electrical distribution and control equipment is used throughout the Center.



The ECAM Size 6 starter in the foreground controls a 250-hp MG set. In the right background is one of eighteen purge control panels which regulate the amount of air circulation and free the air of dangerous vapors before starting the electrical equipment in engine test cells.

FIELD ENGINEERING SERVICE is available to architects and consulting engineers through more than 100 Square D offices, backed by over 1000 authorized electrical distributors and 21 plants in the United States, Canada, Mexico and Great Britain.

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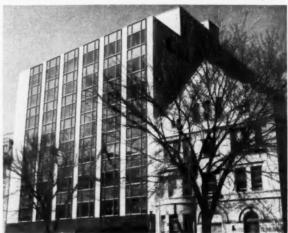
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ADJUSTABLE SPEED DRIVES **BUSWAYS & WIREWAYS** CIRCUIT BREAKERS CONTROL CENTERS **CRANE & HOIST CONTROL** DISTRIBUTION SWITCHBOARDS **ELECTRIC TRUCK CONTROL** HIGH VOLTAGE CONTROL LAUNDRY CONTROL LIFTING MAGNETS LIGHTING AND POWER PANELBOARDS LIGHTING CONTROL-LOW VOLTAGE LIMIT AND FOOT SWITCHES MACHINE TOOL CONTROL MAGNETIC BRAKES METER MOUNTINGS MOTOR STARTERS PRESS CONTROL PRESSURE, FLOAT, & VACUUM SWITCHES **PUSHBUTTONS RELAYS AND CONTACTORS** RESISTORS SAFETY SWITCHES SERVICE ENTRANCE EQUIPMENT STAGE DIMMERBOARDS STATIC CONTROL STEEL MILL CONTROL SWITCHGEAR & UNIT SUBSTATIONS SYNCHRONOUS MOTOR CONTROL TERMINAL BLOCKS TEXTILE MACHINE CONTROL TIMERS **VOLTAGE TESTERS** WELDER CONTROL

Chancery of the Embassy of Switzerland, where gas provides heat for comfort through a Lo-Blast Burner.

National Rifle Association of America. New building is heated throughout with Lo-Blast Gas Burners, installed on roof to save valuable space.







St. Anthony's High School. The Lo-Blast Gas Burner keeps the entire building comfortably warm, from classrooms to the spacious gym.



Economite and Lo-Blast Power Gas Burners operate silently, cost less to install, are well suited for down-draft boilers, and are available in capacities from 70,000 to 20,000,000 BTU.

In Washington, D.C....cost-conscious building owners heat with LO-BLAST GAS burners

Private homes, clubs, schools, government buildings, industrial plants...all types and sizes of buildings in Washington...get top heating efficiency and unbeatable fuel economy with Lo-Blast Power Gas Burners. Consistently low operating costs reflect the advantages of this type of burner.

Versatile Lo-Blast burners adapt easily to any boiler or furnace. With their "inshot" design, all components are outside the firebox for easy access and longer life. Burners operate automatically with forced air injection, independently of variable chimney drafts. You get greater combustion efficiency with all the conveniences and economy of gas heat. For information on Lo-Blast Gas Burners—and their smaller counterpart, the Economite—contact your local Gas Company, or write to Mid-Continent Metal Products Co., 1960 N. Clybourn Ave., Chicago 14, Illinois. American Gas Association.

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"As to the future of engineering, it was never so bright. The young CE graduate is lured with the tempting offers of a dozen Federal agencies; he has 50 highway departments to choose among. He is offered more than he is worth because the old law of supply and demand is, for the present at least, operating in his favor. Professional connections, once formed, are hard to break; be not too much in a hurry. It is true that the world is your oyster but not all oysters have pearls. Ask yourself what it is you seek. If you most desire security it would seem best to enter Federal service; your path will be easier there; if you conform properly to regulations you will receive certain raises in grade and pay. Death and old age will aid you in removing the ones above you and you may, at retirement time, retire like Marcus Aurelius to your cabbage patch to ponder upon a secure though not especially eventful life.

"If, on the other hand, you are say 25 years of age and you have not been inoculated with the virus of security, and you say to yourself 'let 65 or 70 take care of itself,' then I say join yourself to one of the great engineering-construction firms whose projects are world wide or with one of the larger consulting firms. With these people you will never want for

problems to solve and you will be paid in proportion to your ability to find solutions. It seems to me that an engineer could not ask for more. You will not, yourself, be provident, so marry - not too early - a woman who will not mind too much the life of an Ishmaelite. She will take thought for the pence in the pounds and be thereby an anchor to windward. And at the end you may perhaps be buried in the potters' field but you will have had a full life and when you go over, the trumpets will blow as they did for the valiant."-E. B. Bail, New Mexico State Highway Department, in the New Mexico Professional Engineer, July 1960.

Sale of Steel By Consultants

"At the time when the Corporation of Professional Engineers of Quebec was making it very clear to its members that they were not allowed to sell the materials which they had specified as consulting engineers (see the Notice published in the Bulletin, Vol. 15, No. 5; October 1957) the Council of the Province of Quebec Association of Architects and the Council of the Corporation of Professional Engineers approved unanimously the following joint resolution:

"RESOLVED THAT the Corporation of Professional Engineers of Quebec and the Province of Quebec Association of Architects condemn the undesirable practice of

imposing or tolerating the sale of reinforcing steel and/or structural steel as a method of compensation for structural engineering services, as this is contrary to the spirit of true professional ethics and is detrimental to the public;

THAT consequently both professional bodies forbid their members from taking part, directly or indirectly, in this undesirable practice or from permitting it in any matter whatsoever; and

'THAT the Corporation of Professional Engineers of Quebec and the Province of Quebec Association of Architects will take the necessary measures to implement the above policy (in due course).'

"The words 'in due course' appearing at the end of the motion gave to understand that certain measures had to be undertaken in order to ensure efficient control of these abuses.

"The Councils of the PQAA and of the CPEQ have now decided that the time has come to publish their joint resolution and thus give full support to the general reform that has become imperative.

"The engineers' Code of Ethics and Professional Act were amended recently to provide the Corporation with the means to check these undesirable practices. The Council of the Corporation is ready to take corrective action, if necessary.

"The Architects' Association is governed by the same determina-

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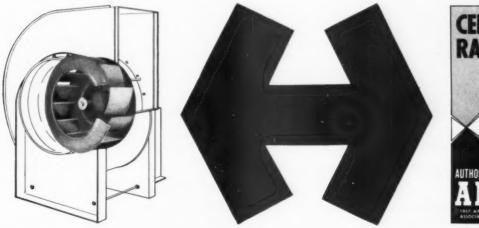
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tion to seek the common good. There is definite assurance of a sincere and full collaboration between the two professional groups in their efforts to ensure the welfare of the public." — Bulletin of the Corporation of Professional Engineers of Quebec, June-July 1960.

Regional Planning

"In the last 15 or 20 years we have seen city planning change in status from something that was barely tolerated—an ivory tower business, not taken seriously—to a vital part of the operations of municipalities. Hard-headed businessmen and politicians now call upon planners for all sorts of information and suggestions.

"Perhaps the principal function of a planner is to determine the best uses of land within the area of the governmental unit which employs him. He prepares general plans of the area, showing proposed land uses. He works out systems of street circulation, of parks and recreation, of schools, of libraries, and so on. The planner prepares zoning codes and maps, but he does not promulgate the codes; this is a legislative function. In many cities (but not in Boston) the planning board exercises control over subdivisions of land and administers the zoning code. The planner spends a great deal of time in collecting data: on population, on physical condition of the area he works in: on the needs of basic utilities: on labor forces: on operations of commerce and industry in order to find out what activities are good and can thrive in the area. He is often called upon to prepare for the city government a program of capital improvements to be made within a few years.

"As I said, the value of the planner's work is widely recognized within municipalities, and the value of planning regionally has been recognized in many metropolitan areas. In the Boston metropolitan area, a move has been on foot for years to establish a re-



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gional planning agency; bills have been presented annually for at least five years, but have got nowhere. This year's bills have been given a public hearing but none is given much chance of passage." — E. C. Keane, vice president, Fay, Spofford & Thorndike, Inc. to Boston Society of Civil Engineers.

Roads and Private Engineering

"Another activity of ARBA's Engineering Division is the continued study of the matter of prequalifi-

cation of consulting engineers as a prerequisite for employment on Federal aid highway work. This work is being spearheaded by W. H. Corddry, with Elmer Timby, John Clarkeson, L. K. Crawford, and Murray A. Wilson as members.

"The Public Affairs Committee, headed by Mason Lockwood, is preparing an informative commentary on the subject of Private Enterprise in Public Works Engineering. Other members of the Committee are F. V. duPont, Robert W. Abbett, LeRoy H. Cather, Gustav J. Requardt, and Chas. M. Upham.

"The Bureau of Public Roads on May 20, 1960, released a Circular Memorandum entitled 'Policy and Procedure Memorandum 40-6-Employment of Consultants.' This memorandum is more definitive and comprehensive than prior releases on this subject. Among other things, it contains:

- Conditions under which consultants may be employed on Federal aid work.
- Outline of procedure for evaluating qualifications of consultants.
- Basis of payment for consultant services and determination of same under various conditions.
- Recognition of practice of various national engineering societies in recommending the use of a curve for determining percentage fees.
- Outline of suggested engineering agreements.

"This thorough document is important because it indicates that the BPR definitely recognizes a continuing need for the services of consulting engineers and intelligently spells out how their services may be utilized on Federal aid highway work.

"ARBA believes that developing a closer and more harmonious working relationship between consultants and public officials charged with constructing the expanded highway system is essential to the efficient and expeditious prosecution of the program.

"We fully recognize the necessity for, and wholeheartedly support, the Federal law requiring that each state have a highway department with adequate powers, suitably equipped and organized to properly discharge its duties. We believe consultant services are needed and hope that they will be used whenever it is found to be in the best interest of the highway program and of the economy of the Nation." - George S. Richardson, president, Engineering Division, ARBA, in the American Road Builder, July 1960.



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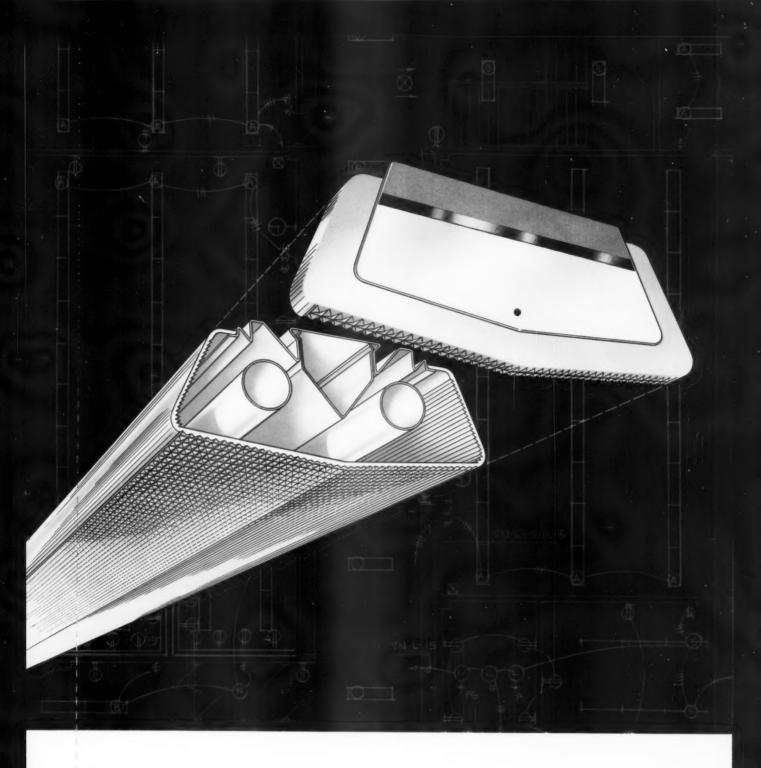
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From the Editor's

Tranquil Tower

Consultants Itch Too

CONSULTING ENGINEERS have been doing considerably better lately in their efforts to promote the welfare of their profession. The National Society of Professional Engineers is quick to note any actions or statements that are opposed to the welfare of engineers in general or private practitioners in particular. Consulting Engineers Council has grown to the point that its reactions carry considerable weight, and the American Institute of Consulting Engineers is stirring when poked.

There is, however, much yet to be learned. We were reminded of this the other day when we received from the Council a letter and considerable backup material relative to "Current Social Security Health Care Proposals" now before Congress. This report was printed by the Council and distributed to its members following a meeting of the U. S. Chamber of Commerce, at which the Council was represented. A. T. Everett, a vice president of Prudential Insurance Company of America, was the speaker. Obviously, the purpose of the U.S. Chamber of Commerce meeting was to get all the help it could from its many member organizations, of which the Council is but one, for its stand against a health care program for the aged being made a part of Social Security.

We have no objection to the U. S. Chamber of Commerce supporting the political position of the insurance companies and, no doubt, the American Medical Association. A quick reading would indicate that they are against "compulsory" programs and in favor of a "private voluntary" approach. Since we have always opposed compulsion and favored a free choice, when the matter was left to us, we hold this to be an admirable stand.

It does seem, though, that the Council may have missed a wonderful opportunity to get a little action for itself out of this affair. If the doctors and the insurance companies are so anxious to get the help of consulting engineers on this matter, then why should they not respond by writing a few letters to their Congressmen for us.

If we remember correctly, it was early in 1958 that the Chamber of Commerce of the United States published a booklet on the Interstate Highway Program in which it strongly recommended the expansion of state highway departments instead of the use of consulting engineers on these projects. When the anti private enterprise aspect of this position was called to its attention, the Chamber said it would sin no more — but the publication is still being distributed in its original form.

Again, it was in 1958 that the U. S. Chamber of Commerce adopted a Policy Statement endorsing the expansion of state and Federal highway departments. When this was called to the Chamber's attention by the Council, it revised this statement by adding the words, "and utilize to the extent possible private engineering firms." That, we feel, is a miserably poor concession for an organization that is suppose to represent private enterprise.

How come the Chamber can take such a strong stand on the side of the insurance companies but can barely bring itself, even when reminded, to faintly praise the engineer in private practice?

We agree with the Council in supporting the current program of the Chamber. To refuse to cooperate would gain nothing. But we see this as an excellent opportunity for the Council to call to the Chamber's attention that, in the future, consulting engineers expect equal treatment with insurance companies. We are glad to write to our Congressmen and express our opposition to compulsory government health insurance, but our insurance men and our doctors — and the Chamber — should start writing some letters, too.

This time they should write in favor of smaller rather than larger state highway departments.

We are glad to scratch them on request, but consulting engineers itch, too.



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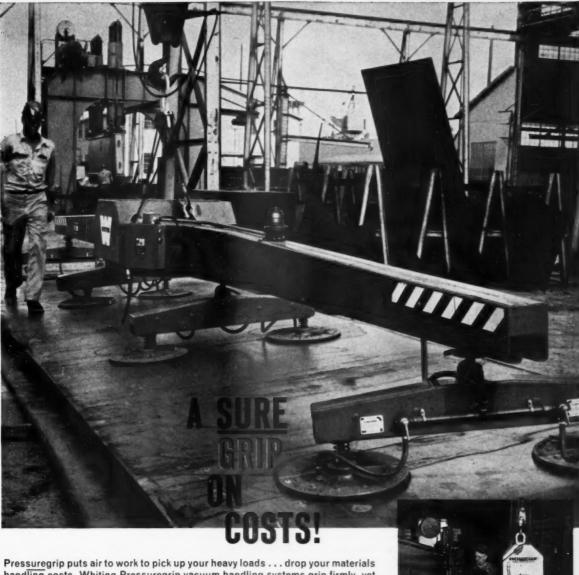
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The Word From Washington



EDGAR A. POE, Consulting Engineer Correspondent

THE Bureau of Public Roads took official cognizance of published charges that there has been "extravagant" use of private engineering consultants, in place of state highway department employees, for design of highway facilities in the Federal Interstate and Defense Highway Program. The criticism appeared in a recent issue of a prominent national magazine, and, in fact, uses the term "mismanagement" in this connection.

Charges Refuted . . . By BPR

Answering the charges in detail, the Public Roads Agency refuted the reference to private engineering use in these words, "Federal highway legislation requires that each state shall have a state highway department suitably equipped and organized to discharge the duties required by the law, and regulations issued by the Secretary of Commerce provide for the use of consulting engineers by the state highway departments.

"A strong and capable state highway department is necessary to a well-designed highway system, whether the design of individual projects is done by state forces or by consulting engineers. Many of the states have made use of consulting engineer firms to accomplish design, and such practice has been very beneficial.

"The use of consulting engineers for specialized engineering design work has made available to highway departments experts in various phases of highway engineering, particularly in the design of urban facilities

"It would have been impossible to obtain these otherwise, and even if possible, it would have been an unwise expenditure to retain them constantly on the regular state rolls. Certainly the employment of consultants has served to expedite the progress of the Interstate Program in many instances. As a matter of fact, the accelerated program made possible by the Federal-Aid Highway Act of 1956 could hardly have gotten off the ground without them."

Further defending the use of private engineering services, the Bureau of Public Roads pointed out that in initiating the Interstate Highway Program, "it was essential that prompt progress be made in the preparation of engineering plans so that lead time required for the orderly acquisition of right-of-way in advance of construction could be provided.

"The use of private engineering organizations to help the states build up this shelf of plans well ahead of their construction programs resulted in more orderly and better right-of-way acquisition. The use of consulting engineers for some of the work gives the states greater flexibility; enables them to secure experts for specialized situations; brings outside thinking into solution of problems;

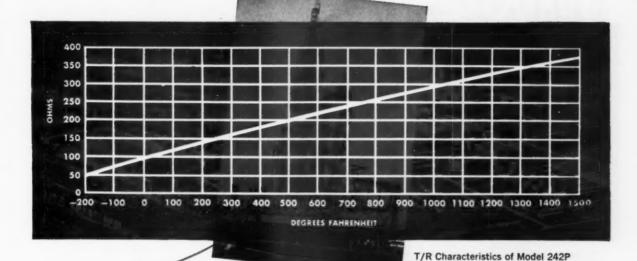
creates incentive for better production from the states' forces by providing a yardstick of accomplishment; and enables work to be accomplished that would be impossible otherwise. . . ."

The Bureau of Public Roads was emphatic in its comments on this particular charge, declaring that "The use of consultants to get the expanded highway program under way has benefited the states and the Nation."

Citing the various advantages gained by use of private talent, the Bureau added that "Certainly these benefits exceed the monetary value of all the work discussed." Elaborating on the policy which has governed payment for such services, the Bureau reports, "Payments for work done by consultants are made on several different bases including lump sum, cost per mile, or percentage of actual or estimated cost of construction for which plans, specifications, and estimates are prepared."

Hitting again at the magazine charges, the Bureau declared, "In all cases, the operating procedures prescribed protect the state and Federal governments. "Under these procedures, there is no opportunity for consultants to enhance their fees through the expedient of extravagant designs. Plans developed by consultants must follow the same predetermined design standards as those developed by regular state highway depart-

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ment forces and must be reviewed and approved in the same manner."

... By NSPE

Paul H. Robbins, Executive Director of the National Society of Professional Engineers, formally commented that "The use of consulting engineers by state highway departments throughout the nation has been with the full consent, approval, and close scrutiny of state highway engineering departments and the Bureau of Public Roads.

"The use of private engineers, as well as other elements of private enterprise in the design and construction of public works projects has proven to be an economical method of doing business. Published facts prove this point beyond question . . .

"A recently completed factual report prepared by an NSPE Task Force shows that a total of \$72,-131,478 was paid to consultants for designing 325 highway projects where total construction costs will be approximately \$2,030,665,000. The \$72 million in fees is a lot of money, but represents only 31/2% of the total construction cost, and anyone acquainted with the work involved would know this to be a very equitable reimbursement for engineering effort and expenses involved."

... By CEC

NSPE is not the only engineering organization interested in this matter of the role of consulting engineers on interstate highway work. Hugh P. Duffill, of Duffill Associates, Inc., president of the Massachusetts Association of Consulting Engineers, has just been appointed chairman of Consulting Engineers Council Highway Committee. One of Duffill's first acts as chairman of this Council committee was to meet in Washington with representatives from the American Institute of Consulting Engineers, the American Society of Civil Engineers, the American Road Builders' Association, and the National Society of Professional Engineers to see what action they might jointly take in this whole field of public works engineering. Richard Tatlow III, president of the American Institute of Consulting Engineers, who called the meeting, has not reported any decision of this Summit meeting, but it is obvious that either the American Institute of Consulting Engineers or Consulting Engineers Council, or the two of them together, will have to front for these organizations, for ARBA, NSPE, and ASCE all must give consideration to their members who are engineers in government and therefore cannot take an unqualified stand in favor of all public works engineering being done by consulting engineers. AICE and CEC as organizations made up solely of engineers in private practice, do not have to do any fence straddling on this issue to maintain peace in their membership families.

Hugh Duffill, as chairman of CEC's Highway Committee, takes the position that while he firmly believes in public works engineering by engineers in private practice, he does not favor antagonizing public officials by beating them over the head with comparative price figures or criticisms of their engineers' work. Instead, he feels that consulting engineers should try to sell themselves to public officials as clients and potential clients just as they would sell themselves to private clients. He points out that in his own state of Massachusetts, almost all highway design is done by consultants and that this has been done by working in close cooperation with public officials, not by fighting them.

. . . And By Scherer

Representative Gordon H. Scherer, Republican of Ohio, has struck back at critics of the Bureau of Public Roads, state highway departments, and consultants.

A member of the Special House Subcommittee on the Federal-Aid

AUSPICES ASME



NIGHT-DAY 6 AMERICANS WORK AROUND THE CLOCK ON NORTH AMERICA'S BIGGEST POWER PROJECT

WORK NEVER STOPS on the gigantic \$720,000,000 Niagara Power Project—largest hydro-electric development in the Western Hemisphere. Consulting engineers are Uhl, Hall & Rich of Boston.

Five big American Revolvers work at three levels on Merritt-Chapman & Scott's \$98,800,000 contract for the main Niagara Generating Plant. By day they handle material, set forms—at night, pour concrete. 1,200,000 cubic yards of concrete and 42,000

tons of steel go into this structure alone!

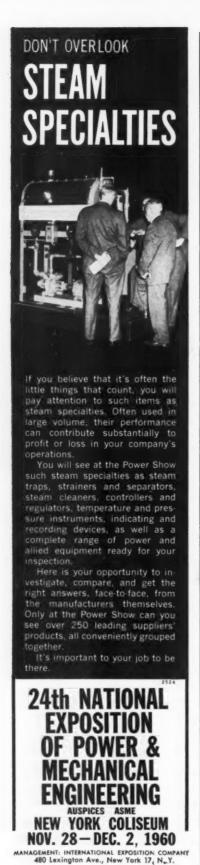
American's work-horse dependability is essential on projects like this where equipment failure or poor performance can slow down work, foul up schedules. Consulting engineers and contractors know that top-rated, tough American Cranes keep jobs on schedule.

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and Derrick Company St. Paul 7, Minnesota EXCAVATORS-CRANES to 4½ yds.-110 tons LOCOMOTIVE CRANES to 130 tons DERRICKS-HOISTS to 800 tons REVOLVER CRANES to 400 tons CROSBY-LAUGHLIN DIVISION

Forged fittings for wire rope-chain



Highway Program, Congressman Scherer declared that some people, in and out of Congress, "panicked" when Federal aid funds were curtailed. Some of these critics made political hay out of the highway crisis. "They looked for scapegoats," said the ranking minority member of the Roads Subcommittee. "The Bureau of Roads and state highway departments became the chief whipping boys and so did private consulting engineers."

The Ohioan declares that he would be the last to say that in a program moving as fast as the highway building program involving millions of people, both in government and in private industry, "you are not going to have some mistakes, inefficiency, waste, and even fraud. As far back as 1956 I discussed at length in Congress the necessity of having a committee maintain constant surveillance over this program."

Representative Scherer, in a warm pat on the back for consulting engineers, declares that the highways they are designing are properly blueprinted for traffic in the years ahead. "One of the principal charges," he said, "was that the Interstate System was overdesigned; that the rights-of-way were too wide and the interchanges too complex; and that the entire highway layout was adorned with too many frills. It was then that the roof fell in on the consultants.

"These charges of overdesign were the answer to the professional bureaucrats' prayer, the boys who believe in bigger and bigger government and the paternalistic, all-powerful State. For some time, these professionals have been attempting to build up and expand the engineering departments of the Federal government.

"This charge of overdesigning gave these boys the club they have been looking for to knock private engineers completely out of government work. Consultants were charged with overdesigning and overbuilding so that their percentage cut for engineering service would be higher.

"To say that the taxpayer will save money by having the various agencies of the Federal and state government set up huge staffs and bureaus to perform all of the engineering services required by government for all of its public works program, including highways, is plain, unadulterated nonsense."

Up Defense Spending

The new Defense Department Spending Bill provides for about \$40.5 billion, about \$1 billion more than President Eisenhower recommended to Congress in January. The "hate the United States" campaign that the World Communist leaders have been heaping on our country is the reason for the accelerated spending. Firms engaged in fabricating missiles and satellites will benefit most.

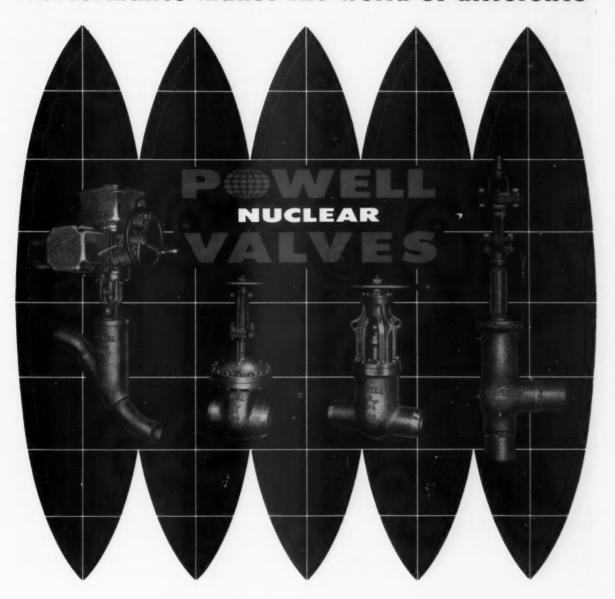
Pending Legislation

While it was planned to hold the post-convention Congressional session to a predetermined schedule, it was not expected this could be done. Meantime, certain holdover legislation deserves mention.

With the Democratic nominee the principal driving force behind current labor legislation, prospects for the situs picketing bill have changed to the positive, with a good chance of action on this controversial labor-backed bill.

¶ Representative Boggs, Chairman of a Subcommittee which considered H.R. 7123, a bill to modify the ban on tax deductions for certain so-called "lobbying" outlays, favorably reported the legislation just before the convention. It would remove the restrictions placed by Internal Revenue Bureau on expenditures which, if unchanged, might have hindered fee payments for expert consultant services if rendered in connection with legislation promotion or opposition. It also would have cast a cloud over deductibility, for tax purposes, of many professional as-

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*4-inch steel Bell-O-Seal "Y" valve for 300 pounds pressure.

Fig. 3003 W. E.—Steel bolted bonnet gate valve for 300 pounds W. P. Bolted bonnet valves can be supplied for pressures from 150 through 2500 pounds.

Fig. 19003-Steel pressure seal gate valve *3-inch steel, Bell-O-Seal for 900 pounds pressure. Also available in 600, 1500, 2500 pounds W.P.

Freeze Seal angle valve for 150 pounds pressure.

*These two valves are specifically designed and made to provide absolutely leak-tight control of liquid metals in the reactors of nuclear power plants.

Keeping pace with nuclear advancements - Powell manufactures valves to handle molten metals and other radioactive materials in atomic power plants-vital and hazardous materials which must be contained in and pass through the valves without the slightest leakage or failure.

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sociation dues payments, if the association was identified in any way with legislative activity.

¶ Analysis of the recommendations of the Highway Research Board's Special Committee indicates that a preponderant amount of the necessary funds for the various projects must come from public appropriations. This raises the question of whether the government agencies concerned will follow through in forthcoming budget proposals with requests for funds.

The Committee recommended some 19 priority research programs, under such headings as: controlling land development in vicinity of freeway interchanges; intensive investigation of accidents; comprehensive study of passenger transportation in metropolitan areas; improvement of highway maintenance; improvement of techniques for forecasting traffic and revenues; and increased knowledge of aggregates and soils.

The total estimated outlays for the various projects range up to \$34 million. The Committee Report suggests in most instances that funds would come from "public, foundation, and operating" sources.

Request Recognition

Enginering groups are taking note of an increasing trend among government agencies to contract abroad for certain research projects, to be paid for out of so-called counterpart funds, as is done now in defense building abroad, and on other similar projects.

The platform adopted by the Republican National Convention at Chicago bears a science and technology plank with recognition for engineers and scientists. The Republicans went on record as expressing "our profound gratitude" to the engineers and scientists of our country, both in and out of government, for the march of progress they have helped this nation make." They went on to declare that the vigor of American science and technology may best

be inspired by an environment of freedom and public understanding in which intellectual achievement and scientific research may flourish. Also, they encourged colleges and universities, private enterprise, and foundations (as a growing source of new ideas and new applications and opportunity for scientists and engineers, in and out of government) to pursue their search with utmost aggressiveness.

C. G. Roush, Chairman of the National Society of Professional Engineers' Policy Review Committee, asked the Republican Platform Committee to develop a platform to include policies that could provide a favorable climate for achieving adequacy in numbers and qualifications of engineers and scientists. Roush, Manager of Westinghouse Electric Co., at Kansas City, also submitted a five-point suggested plank on engineering and science for the Democratic platform.

Powers Extended

The President's emergency powers to set up priorities for defense contracts, to allocate materials, and to make loans for defense plants and materials have been extended two years. The emergency law, enacted first in 1950 at the beginning of the Korean War, will be in effect until June 30, 1962. The law, known as the Defense Production Act, also authorizes the President to order businessmen to cooperate voluntarily in meeting defense needs without anti-trust violations.

At Hoover Dam

The temperature was 113 degrees on the Nevada side of Hoover Dam a few weeks ago when a group of tourists piled out of an air-conditioned bus to make a tour of this great 726-ft high engineering project on the Colorado River.

Within a few minutes, the tourists were on the tour conducted by the Bureau of Reclamation. They did not realize it but the small group helped swell the visitor attendance toward the 8 mil-

in the Chemistry-Geology Building, San Antonio College, San Antonio, Texas



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... which is precisely why Dorex Air Recovery equipment is a vital part of the air conditioning systems of so many new structures, large and small. It has been proved that air conditioning costs can be cut by 78% annually if a system uses Dorex to recover stale, already conditioned air rather than use 100% outside air. Here in the new Chemistry-Geology building, San Antonio College, thirty activated carbon Dorex #52 C Cells, designed into the supply air system in the building's fan room, recover the fume-laden, already used air, convert it to original freshness, and bring about maximum economy in the air conditioning process. The thirty cells have a combined air handling capacity of 30,425 cfm.



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lion mark since conducted tours were inaugurated in 1937. The world has beaten a path to this project in the Black Canyon on the Colorado River between Nevada and Arizona.

It was apparent that some of the tourists who had come many miles across the hot desert land did not fully comprehend the guide's remarks on this multipurpose project until he said that if something happened to that Great Dam, our country would have to evacuate 6 million people who could not survive without the water it provides.

After the elevators had brought the touring group from the coolness of the bottom of the Dam, a woman amateur photographer discovered a plaque midway atop the Dam which explained that the American Society of Civil Engineers chose Hoover Dam as one of this Nation's seven modern civil engineering wonders.

"I'm just about dying from thirst," said the woman tourist. "I agree with the American Society of Civil Engineers, but I wish I had a glass of that clear water from the Colorado."

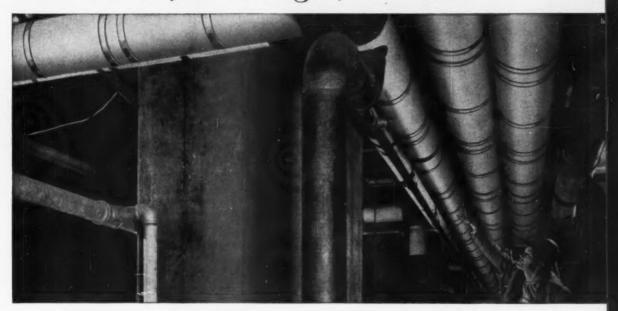
Contractors Bid Low

The U. S. Bureau of Public Roads statistics show that during the last available period in 1959, contractors were bidding 11.8% below engineers' estimates. More recent figures also show a decline of 3.2% in roadbuilding costs so far this year.

Labor Preparing Demands

Top union leaders are already mobilizing for the next big contract negotiations with industry, a year or two away. They are warning local union officials that there is a "spirit of complacency" among the rank and file members. They are calling for an offensive push by labor in dealings with management. One of the major demands to be made in negotiations in 1961 and 1962 will be to add health protection in connection with retirement benefits for older workers.

See why Pittsburgh Corning Products make the things you build look better, last longer, cost less



example: FOAMGLAS® Stay-Dry Pipe Insulation for five important benefits on all building service lines

Insulation for building service lines—iced water, chilled water, low pressure steam or dual temperature—often proves a maintenance headache. Design away that headache with FOAM-GLAS Stay-Dry Pipe Insulation and its combination of five benefits. First, since FOAMGLAS is incombustible and the jacket self-extinguishing, FOAMGLAS Stay-Dry Pipe Insulation substantially reduces fire hazards.

Second, constant insulating value results from the absolute imperviousness of FOAMGLAS to all moisture. Separate vapor seals are unnecessary. Next, the extraordinary compressive strength of FOAMGLAS prevents slump or sag on the highest vertical runs and saddle supports can never puncture the insulation. Fourth, the insulation is furnished with a factory applied Kraft-foil jacket. And fifth, all these benefits can be applied to total piping systems since FOAMGLAS Stay-Dry Pipe Insulation is available in sizes from ½ "copper tubing to 12" IPS with fitting covers and elbows to match.

Following pages describe further the unique benefits of FOAMGLAS insulation for various applications. (Continued)

Take advantage of the coupon on page 4 of this advertisement.

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example: FOAMGLAS, the one insulation combining the seven benefits pictured here



These photographs illustrate a single important point about FOAMGLAS, the one cellular glass insulation. The point? No other insulation wraps up so many important benefits in one material.

However you use insulation, you'll find it of vital importance that FOAMGLAS is completely impervious to moisture—both liquid and vapor. It always delivers the same high insulating efficiency. Its strength and rigidity give FOAMGLAS surprising structural value in many applications ranging from curtain wall panels to roof insulation, to cavity wall or even pipe insulation. The incombustibility and dimensional stability of cellular glass are important in many applications . . . as are its acid resistance and imperviousness to vermin attack.

Here is a single material capable of solving your most demanding insulating problems. A solution which is truly low in cost because of its lasting effectiveness. (Continued)

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example: FOAMGLAS[®] insulation...firm support for the beauty of this curtain wall panel

The beauty of this Mutual Trust Life Insurance Co. curtain wall panel is far more than skin deep. It goes to the heart of those panels: their insulating core of FOAMGLAS.

The unique strength and rigidity of the insulation provide firm support for the panel face and backing. There's no chance of unsightly oil canning or dimpling in laminated panels. Naturally the insulation can never slump or sag within the panels to cause thermal voids. That, plus the moisture-proof cellular glass structure of FOAMGLAS insulation, insures constant U-value for the panel and guarantees weather-tight construction.

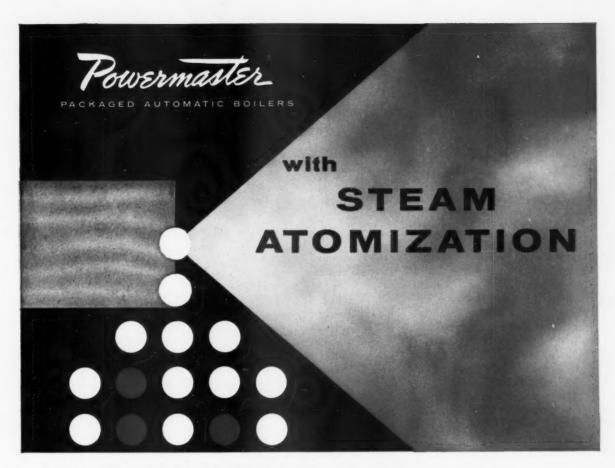
Add all this to the other important benefits of FOAMGLAS insulation detailed on the preceding pages... and it's easy to see why FOAMGLAS has become the standard of reliability for core insulation in curtain wall panel design. (To be continued)

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MARJORIE ODEN, Eastern Editor

PRINCIPALS of Voorhees, Walker, Smith, Smith & Haines, New York City architectural firm (formerly Architects-Engineers) won a recent decision against the American Institute of Architects on the basis of the manner in which AIA disciplinary proceedings were handled. As a result, all of the partners of VWSS&H have been reinstated as AIA members in good standing.

Last November, AIA adopted a resolution finding the VWSS&H partners guilty of violating two parts of the AIA Code of Ethics and suspended the partners from AIA for two years. The two standards which the partners were found to have violated are:

"9. An architect shall not attempt to supplant another architect after definite steps have been taken by a client toward the latter's employment.

"10. An architect shall not undertake a commission for which he knows another architect has been employed until he has notified such other architect of the fact in writing and has conclusively determined that the original employment has been terminated."

According to the decision, printed in the New York Law Journal, the Voorhees principals contended that "mandatory standards are void as being contrary to Federal and state antitrust laws and the public policy condemning restraints on competition." The Judge disagreed, stating that "the

authorities cited by petitioners in support of this position are not in point and the court has been unable to find any authority which held that duly recognized societies of professional people may not promulgate standards for professional conduct similar to those at issue." The Judge added that "It is not disputed that at the national committee hearing petitioners were not afforded an opportunity to confront and cross-examine witnesses upon whom the committee relied in reaching its ultimate determination. Respondent attempts to defend this procedure by claiming that it was employed in order to avoid recriminations between persons involved.

"While it is well settled that disciplinary proceedings of this type need not take on the formalities of a court proceeding, they must adhere to the essential requirements of a judicial proceeding. The failure to allow petitioners to confront and cross-examine essential witnesses was such a serious transgression of petitioners' rights as to invalidate the proceeding.

"In addition, the failure of the regional committee to include a 'digest of the statements of the several witnesses or a transcript thereof' was a plain violation of (AIA) rules, and prejudiced petitioners in the presentation of their defense.

"Petitioners raise several other objections to the proceedings. It is charged that the holding of a hearing in Portland, Oregon, some 3000 miles from the scene of the alleged violation deprived petitioners of the opportunity to have essential witnesses present. This is not borne out by the record, nor does the record disclose that the choice of Portland, Oregon, was motivated by any desire to prejudice petitioners or was in any way arbitrary under the existing circumstances. Similarly, petitioners' contention that they were not permitted to employ counsel at the hearings fails of proof. While it is respondent's admitted practice to suggest that attorneys not participate in its disciplinary hearings, petitioners were free to employ counse! if they so desired.

"Respondent contends that petitioners waived any procedural defects that may have existed by failing to object before the national committee. Considering the entire tenor of the proceedings, the fact that petitioners were not represented by counsel and the failure of respondent's officers clearly to inform petitioners of their rights, this contention must be rejected."

This decision apparently has been noticed by the engineering fraternity. In the future, the American Society of Civil Engineers will notify all persons filing ethics charges against ASCE members that they must be prepared to face cross-examination during the hearNothing takes a bigger beating than your floors...

TRACER LIGHTS show heavy traffic flow pattern along "towveyor" line and on truck-loading dock at Associated Grocery, Inc., Dallas, Texas . Douglas Simril, General Manager • Consulting Engineers: Mullen and Powell • Contractor: Carpenter Bros. • Floor Contractor: Mobley and Speed—all of Dallas, Texas.

2½ tons of food a minute batter these floors...no sign of wear in 5 years

Associated Grocery, Inc., Dallas, took no chances. They installed the best . . . MASTERPLATE "ironarmoured" floors-for only pennies per square foot

Some 300 conveyor trucks, 8 fork lifts and 22 "tuggers"-handling over 2,400,000 pounds of foodstuffs a day-grind away without any sign of floor wear. And because malleable MASTERPLATE floors don't shatter and dust-goods go out clean.

Associated found real economy in MASTERPLATE floors, and that's not all. They can count on MASTER-PLATE to deliver from four to eight times longer wear than the best plain concrete floor . . . no costly repairs or replacement because Masterplate floors are tough enough to take it.

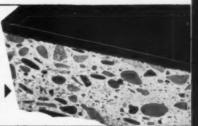
Before you install or replace another floor, call in the local Master Builders field man for full information on this unique "floor package" - a superior product - MASTERPLATE . . . plus on-the-job service by a skilled Master Builders field man.

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- 2. PILOT LIGHTS IF LAMP IS OPERATIVE.
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Meet Highest Performance Standards . . . push button and pilot devices all interchangeably mounted, are sturdily constructed from quality materials and deliver long life and dependable operation on the toughest, heavy-duty industrial applications.

Write today for complete information on these A-H Oil Tight Push Buttons . . . and also on our standard Duty and Heavy Duty Push Button Lines. The Arrow-Hart & Hegeman Electric Company, Dept. CE, 103 Hawthorn St., Hartford 6, Conn.



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ings if the defendant expresses a desire for such action.

William H. Wisely, executive secretary of ASCE, explained that ASCE disciplinary hearings always have been held under rather open rules. "We always have complied with any reasonable request from an accused engineer, and we would regard a request to cross-examine the person making the charges or a request for the transcript of proceedings as a reasonable request." However, he could recall no disciplinary hearing at which such requests had been made. "After all, members of ASCE are professional men and we treat them as such during any disciplinary hearings," Wisely added.

EJC Adopts ASCE Policy

Engineers Joint Council has adopted the American Society of Civil Engineers policy (sans anything objectionable to government employees) on the use of consulting engineers on public projects. ASCE submitted the policy, with a request for action, to EJC. Consulting Engineers Council, which could have done the same with its recently adopted policy, instead merely sent EJC a copy with no request that anything be done.

Surveying, Mapping, and Ethics

Some time ago, the American Society of Civil Engineers declared four major categories of surveying and mapping are professional activities in the civil engineering field. Now this decision is being taken one step further. The word is being disseminated to all photogrammetrists that they "shall not bid" for projects. They are to offer their services only under ethical procedures in the future.

ASCE headquarters also is sending letters to persons handling land, engineering, geodetic, and cartographic surveying. Government officials are being cautioned not to offer surveying and mapping projects on a bid basis, and the ASCE Committee for Professional

CONSULTING ENGINEER

Practice is considering the possible need for a fee schedule to cover surveying and mapping.

According to John G. Ladd, executive secretary of the Association of Professional Photogrammetrists, his group is busy changing its policies to conform with the newly declared professional status (Readers' Comment, p. 40).

More Money, Same Dues

The American Institute of Chemical Engineers, like all other engineering organizations, currently has more ideas than money. It also has a very optimistic approach to this problem.

Members of AIChE are requested to make an annual contribution to the Chemicals when they pay their dues. The Chemicals figure many of their members well can afford more than the dues, but they do not want to raise dues because of the hardship such action would cause to beginners.

What would they do with this windfall? According to John Mc-Ketta, chairman of the contributions committee, the Chemicals would like to:

¶ Add a man to the National staff. His only job would be to work with local and student sections in arranging for speakers, planning section and chapter tours, and handling similar activities.

¶ Improve the employment services offered to members — either through the Engineering Societies Personnel Service or otherwise.

¶ Publish more technical papers, and increase the coverage of some nontechnical publications.

Will You Get a Letter?

The American Society of Civil Engineers is sending censuring letters to several engineering firms which have permitted their names to be used in what the Professional Practices Committee considers objectionable advertising. At the Reno convention, the committee studied several ads from engineering publications and recommended



GREATER WIRING ROOM . . .

making wiring easier, faster.

TWO WIRE ANCHOR HOLES . . .

at each binding screw for holding wire when looping around binding screw.

BIG BINDING SCREWS . . .

with deep-cut slots, for gripping wire firmly, assuring permanent holding and strong, positive connections.

QUIET, MECHANICAL ACTION

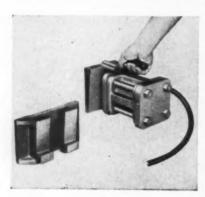
AVAILABLE IN BROWN OR IVORYLITE

FOR FULL INFORMATION... on the new Arrow-Hart Space-Saver Quiette Switch and the complete line of Arrow-Hart Quiette Switches, write to Dept CE, The Arrow-Hart & Hegeman Electric Co., 23 Hawthorn St., Hartford 6. Conn.



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the letters of censure. There is a possibility that a separate committee or a subcommittee may be formed to give more attention to questionable advertising by ASCE members in the future.

Dismissal of McCamy Case?

Attorneys for William J. McCamy, the New Jersey engineer accused of practicing architecture in connection with the design of a country club and a house, and for the New Jersey Society of Professional Engineers, have moved for dismissal of charges brought by the New Jersey State Board of Architects.

If the dismissal is not granted, hearings are expected to resume this month. The architects have concluded their case.

Unfortunately for McCamy, he was selected by the architects to become a "test case," which is being closely watched by engineering and architectural organizations throughout the nation. Most of the prior hearings have centered on what is architecture" and "what is engineering." The architects are attempting to establish court precedent that all space design is in the architectural sphere. Witnesses have testified that the only structures which should be designed by engineers are power houses, dams, bridges, and sewage works.

Nobody has even suggested that McCamy, a consulting structural engineer, did not do a good job on the house and the country club. In fact, McCamy is all but forgotten during most of the ivory tower testimony on definitions of architecture and engineering. But if the Board conducting the hearing decides the architects have a case, McCamy could be subject to fines for both projects, and his license might be at stake.

New Jersey engineers have rallied to McCamy's aid. To date, more than \$10,000 has been donated for his defense.

Arthur W. Lewis, who is conducting the case for the engineers, filed a 23-point motion for dismiss-

al. Among his contentions is that licensing is intended as a protection of the public instead of the creation of monopolies for the benefit of architects or anyone else. "If registration statutes were for the interest of the profession itself — such laws would be class legislation and, therefore, unconstitutional. The architects, their witnesses to the contrary notwithstanding, are not the sole guardian of public welfare in the areas of buildings and structures," he said.

EJC To Broaden Membership

At a board meeting Sept. 9, Engineers Joint Council is to consider allowing organizations with "common interests" to affiliate. For some time now, several groups with both engineers and scientists as members have wanted to affiliate with EJC but present rules insist that all EJC constituents have only engineer members. If the proposed affiliations were allowed, organizations without individual membership requirements also could become affiliates. EIC explained that affiliates under the proposed rule change would have no vote, could take part in discussions, and would be charged only token dues.

Another Highway Story

As a result of complaints from the American Institute of Consulting Engineers and from the National Society of Professional Engineers, *Reader's Digest* has indicated it may run another story on the Interstate Highway Program — this time not so critical of consulting engineers.

Richard H. Tatlow III, Institute president, wrote *Reader's Digest* that: "Do you know that it is not 'extravagant' to use Consulting Engineers? That, in fact, their efficient operation costs less than manning, training, and supporting a permanent (government) staff? Do you know that the use of Consulting Engineers does not violate Federal policy? Why mention fees paid to Consulting Engineers with-

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out stating the comparable cost if their services were not used? . . . Members of our Institute have long — and repeatedly — been engaged by private business, industry, and Government; they could not be guilty of the misconduct Mr. (Karl) Detzer insinuates and still remain in operation."

Tax Troubles

Engineers Joint Council celebrated the anniversary of its year-old application for a new tax classification by requesting an autumn meeting with the Bureau of Internal Revenue. EJC is understandably nervous. No new tax classification and EJC could not move into the new Engineering Head-quarters building next year. The application was filed as soon as possible after EJC incorporation in the summer of 1959. Not until last June was EJC notified its application was being considered.

Engineers Council for Professional Development was successful in getting the necessary reclassification allowing them to tenant in the new headquarters, and it is waiting to see what happens to EJC before doing anything else toward a merger.

Free Engineering

The New York Association of Consulting Engineers is planning to concentrate committee efforts on the solution of what they found by a survey to be their primary "free engineering" problems:

Submission of alternate designs by contractors or vendors (especially structural) directly to the architect or client causing the consulting engineer to spend time to review alternate designs or defend his own design.

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Raymond J. Rice, committee chairman, explained that "elevator companies hold many details and ratings of their equipment to be confidential and unlike other industries such as air-conditioning, lighting . . . make no effort to educate the engineers in the application of their products."

The Association is hoping to work with the New York City chapter of Producers Council in solution of many "free engineering" problems. An educational program also will be conducted among Association members stressing that it is unethical for consulting engineers to accept free engineering services when offered.

The CE on Public Works

R. H. Tatlow III, president of the American Institute of Consulting Engineers, recently called a meeting of representatives of interested engineering associations in Washington for a discussion of proper procedure in solving the problem of the appropriate role of the consulting engineer on public works projects. The meeting was held in Washington in the National Society of Professional Engineers' headquarters building on Tuesday, July 26. AICE was represented by Tatlow; J. T. McCarthy, vice president; R. B. Richards; and James P. Exum.

Major General Louis W. Prentiss, executive vice president, and Steven H. Meem, managing director, represented the American Road Builders' Association; while Milton F. Lunch, legislative counsel, and L. M. Van Doren and Alfred H. Samborn, of the Functional Section for Engineers in Private Practice, represented NSPE. Van Doren is the new chairman of this national section, while Samborn is the immediate past chairman.

Consulting Engineers Council was represented by its national president, Hueston M. Smith; the chairman of its private enterprise committee, C. E. Evanson; and the chairman of its highway committee, Hugh P. Duffill.

There has been no announcement of any actions taken at this meeting, but the group had lunch



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with a number of government persons that included Bertram Tallamy, of the Bureau of Public Roads, and representatives from the Army Corps of Engineers, the Navy Bureau of Docks & Yards, and the Department of Interior. It is understood that even after luncheon the group remained opposed to the overthrow of the government by force.

It was reported that these organizations will attempt to keep each other informed of their separate activities in this field through a joint committee.

Problems in Colorado

Vernon E. Konkel, president of the Professional Engineers of Colorado, a director of Consulting Engineers Council, and a partner of the firm of Ketchum, Konkel & Hastings, Denver consulting engineers, said he will investigate alleged unethical practices among consulting engineers in the State. He stated a controversy arose after the city of Thornton allegedly accepted bids in connection with an engineering survey of certain of its street problems.

In April, the Colorado division of the American Society of Civil Engineers and the Consulting Engineers Association of Colorado issued a protest after the Aurora firm of Broyles and Fensten was awarded a \$2000 contract for the Thornton study.

Bill Alexander, chairman of the city council's street and alley committee, reported that three other firms said they could do the survey for prices ranging from \$5000 to \$7000. The other firms were Lane Engineering, of Denver; Peterson, Norris and Carrillo, of Denver; and Nelson, Quick and Haley, of Greeley. The Aurora firm was chosen without consulting them about charges, Alexander said, and "his committee was pleasantly surprised to learn about the relatively low cost."

The firm later said its price would do little more than cover

costs, but that it was interested in getting business from the city.

Konkel said a three-man committee will be set up "to help any prospective client determine a fair range of fees for any particular project, leaving the client free to choose an engineer on the basis of reputation and presentation and with no fear of being overcharged because of lack of competition." The committee will serve without pay, and be dedicated only to helping those who may be unfamiliar with the exigencies of hiring engineers for needed projects. It also would, upon request, investigate charges of incompetence. It would not, Konkel emphasized, recommend certain firms for projects.

EJC-AIA Committee

The Engineers Joint Council— American Institute of Architects joint committee did not meet during the summer, but a number of key issues are expected to come up at the September session.

Just before adjournment in late June, the EJC-AIA committee approved a professional liability and responsibility report, subject to discussion and change. The report then was submitted to executive board members of both societies.

Another report that did not meet with such ready acceptance—at least from the engineers—was the "Division of Responsibility Among the Design Professions—a Guide for Collaboration." This report seemed to outline what engineers can do, right down to the tiny details, with everything not mentioned being left in the architectural sphere. As one engineer put it, "I am not anxious to endorse a document that would prevent engineers from designing buildings."

The joint committee recently dissolved its legislative committee, explaining that legislative problems usually can be handled better on a local level. In the future, any problems in this area will be referred to the local collaboration committee.

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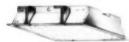
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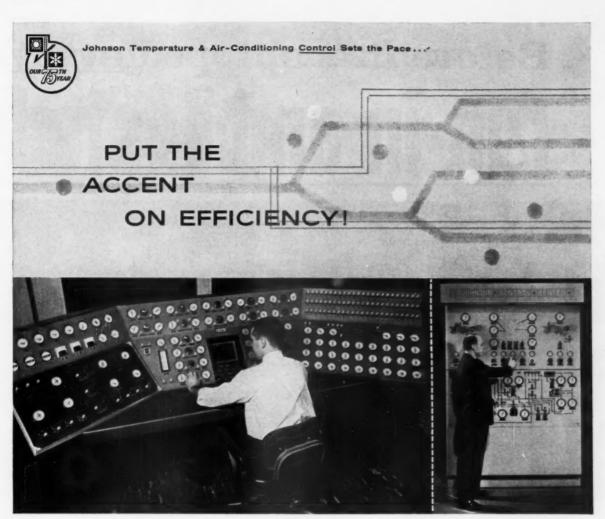


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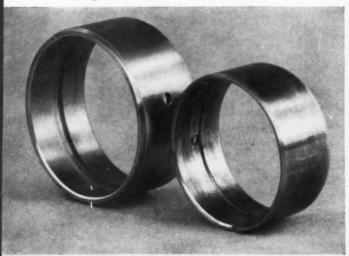
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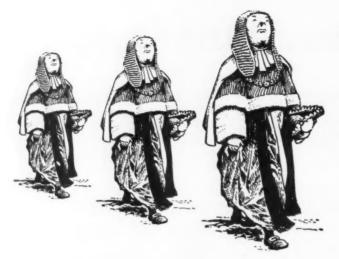
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The Legal Aspect

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Consultant in Legal and Technical Problems
Patent Attorney

Recent Federal Cases
On Air and Water Pollution

THE United States Supreme Court recently handed down two decisions relating to air and water pollution — problems of interest to consulting engineers.

Air Pollution

Huron Portland Cement Co. v. City of Detroit, 4 L. ed 2d 582, decided April 25, 1960, was an action instituted by the Huron Portland Cement Co., a corporation engaged in operating steam vessels in interstate commerce on the Great Lakes and the Detroit River, to enjoin the City of Detroit from enforcing its air pollution ordinance against the corporation's steam vessels.

The Detroit ordinance allows a smoke density equal to No. 3 of the Ringlemann chart for a 3-minute period in any 15 minutes when building a new fire. It makes no special exception for vessels. The company contended that it was impossible for it to comply with the provisions of the Detroit ordinance without making structural alterations since the allowed smoke density always was exceeded when the vessels fires were being cleaned.

Huron did not attack the ordinance generally, but contended that it was unconstitutional to apply it to the company's vessels which were: (1) Federally licensed, and (2) engaging in in-

terstate commerce (although, at the time, in the port of Detroit).

The first argument was based primarily on the theory that Congress, in enacting the laws governing inspection, approval, and licensing of steam vessels, has preempted the field, and thus prohibited states and cities from applying their regulations to such vessels. The court held, however, that the purpose of the Federal inspection statutes is to insure the seagoing safety of vessels subject to inspection, whereas the sole aim of the Detroit ordinance is the elimination of air pollution to protect the health and enhance the cleanliness of the local community. Thus, there was held to be no overlap between the scope of the two laws, and hence no pre-emption of the field by the Federal law.

Huron's further argument that the granting of the Federal license gave these vessels an absolute right to use the navigable waters of the United States, free from local impediments, also was rejected by the court. While a state cannot exclude a Federally licensed vessel from operating in its waters, this does not mean that such vessels are excluded from the normal operation of the local police power. The ordinance does not exclude a licensed vessel from the port of Detroit; it merely requires it to

conform to the same smoke standard to which everyone else is held.

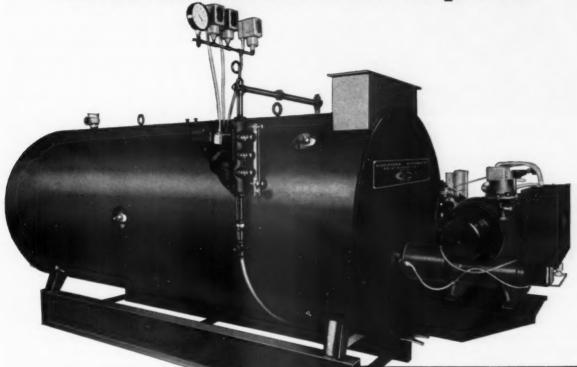
The company's second basic argument, i.e., that the Detroit ordinance unduly burdened interstate commerce (even if Congress has not pre-empted the field), was based on the contention that other local governments might impose different requirements as to air pollution. Such nonuniformity, it was argued, would unduly burden interstate commerce, since it would be difficult, or impossible, for a vessel to meet each requirement as it moves from place to place. This argument was rejected by the court, on the ground that no such variation from one locality to another was actually shown. The final decision was 7-2 in favor of the City of Detroit.

Some problems remain more or less open or unsolved, however. There remains, for example, the question of what happens if, in the next case, it is shown that there actually is a variation in smoke density requirements from locality to locality along the path of similar vessels. (There is, in fact, such a variation along the Great Lakes and the Detroit River.) It is believed that this will not change the result, provided the regulation in question is itself reasonable.

There remains also the problem of how to serve process on smoking

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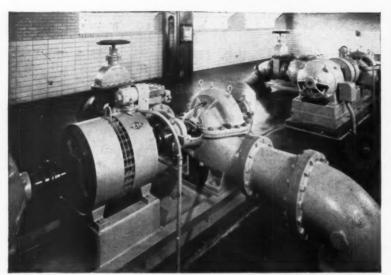
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ships passing a city without stopping. This problem has not been solved as yet, but it is a definite source of difficulty in such ports as Detroit. It is questionable whether mailing the summons to the home office (if that is in another state) is sufficient. Whether there is any simple solution is not known as yet. It is something that requires invention.

Water Pollution

In United States v. Republic Steel Corp., 4 L ed 2d 903, decided May 16, 1950, the defendants, in operating iron mills on the banks of the Calumet River, a navigable river, discharged industrial waste containing various solids into the river, thereby reducing the depth of its channel from the depth of 21 feet which is elsewhere maintained in the river (and which is required by some vessels operating in the river) to 17 feet in some places and 12 feet in other places in the vicinity of the mill.

The Federal government, acting at the instigation of the Corps of Engineers, sought injunctive relief, since the company had refused to dredge that portion of the river. The theory was that this pollution of the river created an obstruction to the navigable capacity of the river, in violation of the River and Harbors Act. The same statute also prohibits the discharge of "any refuse matter of any kind or description whatever other than that flowing from streets and sewers and passing therefrom in a liquid state, into any navigable water of the United States . . .

The United States Supreme Court held that these deposits created an "obstruction," and also that these discharges were not exempt as being "in a liquid state," because they were in suspension rather than in solution.

The court held that injunctive relief should be given, which presumably would order the removal of the obstruction and prevent its being built up again.

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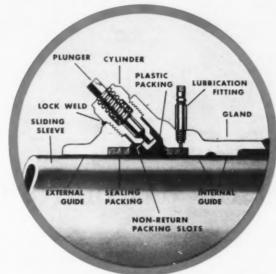
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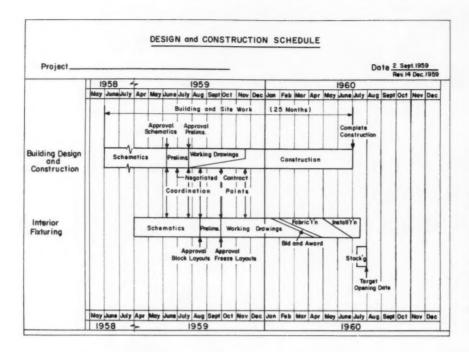






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How to Control Costs in a CE Firm

RICHARD H. TATLOW III, Abbott, Merkt & Company

THE FISCAL SOUNDNESS of a consulting engineering firm begins with the es-

Cresclusive gineering firm begins with the establishment of an adequate fee, a fair form of agreement with the

client, and proper payment for reimbursables and changes in the work. From this point on, the consultant must have a scheduling and cost control system that is effective in use yet simple enough to be maintained easily.

Contract Provisions

Most Abbott, Merkt contracts are based on a fixed fee, to which is added our direct technical payroll and an allowance to cover overhead. If desired, this entire fee also may be limited to some agreed maximum, such as a dollar amount per square foot of building area.

We believe this financial arrangement has advantages over the percentage type fee. It is realistic because it is based directly on the consulting firm's own experience. For example, we know that overhead is an extremely "real" cost, amounting, in our firm, to about 35 percent of gross income.

Items included in overhead and their distribution in an average year are:

General and Administrative

 Insurance
 2 %

 Licenses, legal, & auditing
 1½%

 Depreciation
 2 %

 Miscellaneous
 3 %

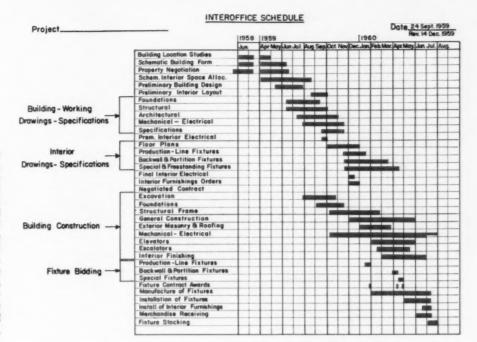
 Total general & administrative
 88%

 Promotional
 3 %

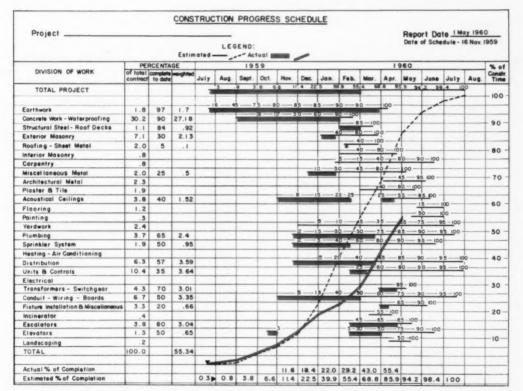
 Salaries
 6 %

 Public relations
 6 %

The biggest item in overhead is the nonchargeable salaries, including vacations, sick leave, holidays, clerical work, and unassignable time. As for



Interoffice — This schedule is simple to read and is of value during the design and drawing stage for scheduling work and checking progress. I personally like to see it prepared and used by every project manager, but this is not always done. When used, this is another early effort to predict the total time needed for each project detail.



Construction Progress Schedule — This is our secret weapon for getting a job completed on time. As soon as bids are let, we join with the contractor and make an extremely detailed prediction of when each portion of the job should be completed. The predictions are the thin black lines on top of the bars. The red bars show actual progress. Then the black dotted curve is the prediction, made jointly with the contractor, of how the well-run project will go; the solid red line (which in this example shows the contractor to be two months behind) represents actuality. The contractor, with our help, revises this chart monthly. One copy goes to the client. We find contractors do not take these charts seriously at first. However, the charts are easily followed by the client and, after a contractor has been called upon to explain several delays, more projects are completed on time. This chart becomes the project speedometer.

Client					D.	ate 9/2	2/59	
Location					Cont	ract Number	r	
Type of Job								
Total Ar	ea - 16	0,000 sq 1	t at	\$12.00/s	q ft = \$1	,900,000		
Estimated Total	Const	uction Cos	t \$ 1	,900,000	Contra	ct Price \$		
Preliminary Dra Design Work (Ot	wings S	Started	- 1	Working	Drawings :	Started		
Design Work (Ot	her Div	visions) N	lone	Estima	ted Cont	ract	Esti	mated
		ner Side)		Cost				ayable
Design (See N	ore or	ier side)		\$	\$	%=\$		
Architectural				\$	\$	7,=\$		
Structural_				\$	\$	%=\$		
HV&AC				\$	\$	%=\$		
Electrical				\$	\$	%=\$		
Plumbing & Spri	nkler_			\$	\$\$	%=\$		
Budget Hours Av	ailable	:			Fee O	n F	ee Ad	justed
Budget Heart H		623 cents	sa ft		Estimate			tract
Estimated Total	Fee At		-4		\$ 100,0		0011	02 00 0
Less Field Supe			tal F	ee)	S	S		
Months at				,	S	S		
Net Design Fee	-				\$ 100,0	00.00 \$		
Less Est.Fee Pa	vable (Other Div	.)	%	S	S		
Est. AM&Co.Inc.				-	\$ 100,0	00.00 \$		
Est. Salary Cost			esign	Fee	\$ 40,0	00.00 S		
Budget Hours Av	ailable	(At \$ 4.0	00 Per	Hour)			ours	
Total Man Hours								
		% of				Div Aver		
	Cost	Est.Cost	D %	Fee		Man Hr Wg		
Indust.								
Des. Prel.	5% of	Net Design	Fee				400	10
Arch.		Net Desi			7,700	4.00	2100	50
Struc.		tal Cost		17,000	6,800	4.00	2300	
HV&AC (\$2.00)	320,00	0	412	14,400	5,700	4.00	1530	35
Elec. (\$2.25)	360,0	10	45	16,200	6,200	4.00	1700	40
Plg-Spr (\$1.00)	160,00	0	41/2	7,200	2,800	4.00	670	18
Specs					1		160	4
Site-Dev	2% of	Design Fe			700	4.00	180	43
Sup & Co		Design F			3,800	5.00	800	20
Tot Man								
Hrs. Altd							9840	224
Note Special De	sign F	lgures:						

Budget Data Sheet — This we use to budget our work on any job and sometimes to help decide what a fee should be. Note that on this hypothetical project an assumed construction cost per square foot was used. Hours are computed on the basis of established costs. We carry the net design fee through this chart, establish our costs, and come up with a total number of man-hours needed and the approximate cost of doing the work. This is then discussed by the department heads, and it serves as a guide for our next move. (The vice president in charge of production makes out this budget.)

Job No.
Division
Date 9/22/59
Client
Location
Type Building 2-Story Department Store
Project Manager or Coordinator R.O.W.

Below find total budgeted design and engineering man hours (WHICH INCLUDED CHECKING OF SHOP DRAWINGS) allotted your division. This has been projected against the estimated cost at

	Wkg.	Shop	Total		
	Dwg.	Dwg.	M.H.	Initial	Date
Indust					
Design			400		
Arch			2100		
Civil Engr			180		
Struc Engr					
Incl Specs			2300		
HV&AC					
Incl Specs			1530		
Elec					
Incl Specs	1		1700		
Plg-Spr					
Incl Specs			670		
Specs			160		
Proj Man					
& Admin			800		
Field					

Note: You are requested not to charge time against the job until the last two columns have been initialed and dated by P. A. Cumnius, or E. P. Johnson in his absence.

Do the last changes you made affect another division? IF SO, INFORM THEM.

Total Budgeted Man-Hours — This chart is prepared from the Budget Data Sheet and repeats the number of man-hours previously determined. The sheet must be initialed and dated by each department head to show that he is in agreement; if he has any reservations in regard to his allocation for the project, this is the time for him to bring them up.

BUDGET COST RECORD

	DESIGN	1%	ARCH	%	STRUC	%	HVAC	%	ELEC	0%	PLBG	%	COORD	1%	INDUST	%	SPECS	%	TOTAL
BUDGETED MH	400		2100		2300		1530		1700		670		800		_		200		10,000
9/11/59	36									1									
	36																		36
9/18/59	31																		
	67																		67
9/22/59	38																		
	105																		105
10/2/59	40		40		20														100
	145		40		20														205
10/9/59	40		38		40														118
	185		78		60														323
10/16/59	40		71		70														181
	225		149		130														509
10/23/59	30		80		80		20					T							210
	255		229		210		20												714
10/30/59	20		101		120				15										266
	275		330		330		20		15										970
			1	1	1			1				-		-	1	-		-	

Budget Cost Record — The man-hours each department should spend on a specific job are translated to this cumulative record, which is updated each week to show how we are doing. Weekly figures are in red for "across the room" comprehension. This chart is frequently the basis for discussion between department heads and management.

PROJECT Jones Hts.

JOB NUMBER 630

SHEET I of_

TOTAL	M.W.	JOB			APR	TIL			M	Y			JU	NE			J	ULY			AUGUST			SEF	PTEM	BER				
M.W.	CONSUM TO DATE	NO.	NAME	8	15	22	29	6	13	20	27	3	10	17	24	1	8	15	22	29	5	12	19	26	2	9	16	23	30	
		519-III	GSP																											
5	21/2	532-A	Garage Addition																											
		575	Warehouse																											
		587	Small Stores																											
70	72	630	Jones Heights																											Complet
		635	Paramus						X									X												
5 4	19	640-C	Cold Storage																											
30	8	642-8	Addition To Warehouse						-			-																		
55	541/2	643-B	Warehouse																											
15	13	648-AC	Drugs																											Complete
T.M.	-	650	Janus		*																									
50	32	652	Shopping Center																											
30	3	653	Warehouse																											
TM	-	661	Distributing Center																											
12	12	663	Northaide																											Complete
4	21/2	667-ABC	H.V. AC																											
6	5	673	Store	F							-																			
12	4	674	Pittsford, S.C. Design Studies																											
T. M.	-	676	Peddie School																											
48	0	677	Southside													F														
			Shopping Center																											
			Vacations																											
			Miscellaneous Design Changes	-								-	-																	
	+		Estimated M.W. Required	-	12	12	13	12	12	11	13																			
		_	MW.Consumed to Wk. Ending																										Wo	rk Load by Div.
			4/8/60																							STI	V.	No.	n 12	4-8-6

Man Power Forecasts — These charts are the regular means of reporting to management. In the lower right hand corner is the name of the department and the number of men on its payroll. Each line on the chart represents one man, and an "X" indicates a potential, but then unknown, man power demand. Vacations are taken into consideration as well as time required for such variables as change orders. In any week (and schedules are as far ahead as practicable), this tells us how many men will be available and what the needs will be, based upon signed contracts. According to this structural department chart, the work load is balanced through May. If a department begins to look depressed, the question is either new work or a cutback. If the opposite situation prevails and a department needs more men than it has available, a look ahead on the chart provides the answer — overtime or hiring.

promotion and public relations – shown as 12 percent of overhead – all consulting engineers have this cost, in one form or another, whether they hire a public relations counsel (as we do) or conduct their own campaigns. In fact, all items of overhead are as much a part of doing business as direct productive payroll itself. This must be recognized when setting the fee.

Reimbursables and Changes in the Work

In addition to the fee, our contracts stipulate that we shall be reimbursed monthly for our direct costs as follows:

¶ Actual cost of travel and subsistence of our men while away from New York on the client's work.

¶ Long distance phone calls, telegrams, & cables. ¶ Actual cost of reproduction of working plans and specifications.

¶ Our full-time resident engineer's salary, +20%.

¶ Actual cost of professional renderings and reproductions in excess of one, if authorized by client.

¶ Actual cost of models, if authorized by client. ¶ Direct added cost of overtime payroll premiums as approved in advance by client.

Cost of building permits and fees.

Actual cost of the testing of concrete, steel, and soil, or their inspection by recognized laboratories in mill, shop, or field.

Our contracts also spell out clearly the procedure for handling changes in the work. On any project, job conditions may necessitate changes, or they may be requested by the owner, suggested by the engineer, or demanded by local authority. Still, the only change order for which a consulting engineer can charge a client is an authorized order. We make sure we have authorization on record.

Each design change is given a number, together with the requestor's number. Then a detailed

memorandum is circulated to all department heads, and a copy is sent to the owner. In addition to this memorandum, our contracts state that "if, during the preparation of working drawings, or thereafter, you should instruct us in writing to make changes in our drawings which cost more than \$200 of direct technical payroll, we are to be reimbursed at two times payroll for the entire cost. Costs for changes will not be included in the 'Compensation' set forth above." There is also the possibility that the client may simply put a limit of \$500 on cumulative changes.

Cost Control

With equitable ground rules established, our management emphasis during the course of the project is on cost control in man power, money, and that great intangible, time. We make sure we know what is going on, and we keep the owner and the contractor informed regarding the progress being made. Thus, our cost control system, as well as being indispensable to our own operations, becomes an important tool in client relations.

Before bids are taken for construction, we make out a preliminary cost record. At this point, we must rely on a "horseback" opinion of costs, but this lets the owner know approximately what his total out-of-pocket expense will be. All costs are itemized — everything from land and engineering costs to financial charges and even the owner's

expense of moving to the new building. On a typical project the list would include:

¶ Investigation & control

¶ Municipal & utility charges

Site preparation (grading)

Subgrade work (piles)

¶ Building structure

¶ Building finish

¶ Vertical transportation

Site development (paving, etc.)

Mechanical trades (H.V. & A.C., plumbing)

¶ Electrical systems

¶ Lighting fixtures (lamps)

¶ Fire protective systems (sprinklers)

Other protective systems (A.D.T.)

Basic operating equipment

Interior fixturing; materials handling equipment

¶ Moving & miscellaneous items

¶ Design fees

¶ Reimbursable cost

¶ Financial charges

¶ Owner's administrative cost

¶ Land

¶ Contingency

This cost record is kept up throughout the course of the project. Each month the appropriate figures are entered for each item, and changes also are listed, with explanations, at the bottom of the chart. On a well planned project, the beginning estimate should approximate but be on the low

side of the last figure on the chart

- the final cost.

Besides this cost record, we use a series of charts to maintain control over the project. These are shown and explained in detail* in the accompanying illustrations. Basically, they help us in scheduling and following the progress of design and construction and in budgeting both money and manhours. They also are the basis for coordinating all of our projects, department by department.

Properly used, these charts should show a consultant how to make a profit—or give him advance notice that he is going broke. At least the financial aspect of private practice is assured to the point of paying taxes. Money, unfortunately, is not for the consulting engineer—it is something other people seem to have.

These charts do not indicate exact project names or figures, However, all costs and percentages are representative.

TYPICAL ESTIMATE OF OPERATING RESULTS AND CASH BALANCES

Month	Estimat	ed Total	Profit	Cumulative	Approximate
	Fee Income	Oper. Costs	or (Loss)	Profit or (Loss)	Cash Balance
3 Month	hs to March 31			\$ 50,000	\$100,000
April	\$160,000	\$129,500	\$30,500	80,500	120,000°
May	145,000	101,300	43,700	124,200	163,700
June	137,000	75,100	61,900	186,100	225,600
July	102,000	70,400	31,600	217,700	232,600*
Aug.	70,000	70,400	(400)	217,300	232,200
Sept.	50,000	104,600	(54,600)	162,700	177.600
Oct.	30,000	70,400	(40,400)	122,300	137.200°
Nov.	45,000	70,400	(35,400)	86,900	101,800
Dec.	70,000	70,400	(400)	86,500	101,400

^{*} Cash to Profit Sharing Plan

Operating Results, Cash Balances — These charts are made for presentation at management's monthly meetings, and we try to look one year ahead (as far as we can with any degree of accuracy). Since monthly operating costs can vary, depending upon pay periods and size of staff, we figure everything on the basis of current staff and pay practices; these also include overhead costs. Reason for the variance is that we pay every two weeks, so some months have three pay periods. Our fees are paid monthly, and we generally receive all checks by the third week. Accounts receivable should not total more than 10 percent of billings.





Sewage Treatment

"A sustained and vigorous attack on water pollution in this country is a must. Despite billions of dollars spent for waste treatment facilities, the construction of these facilities has not kept pace with the growth of our population and the expansion of industry. I believe the leadership displayed by the Public Health Service in recent years should challenge industry and state and local governments to step up construction of waste treatment works to remove much more pollution from our water supplies."—Arthur S. Fleming, Sec. of Health, Education, and Welfare.

Local Funds and Federal Aid

THE PASSING OF THE PRIVY, with its oak

CEexclusive

seats, sliverless peeled pine pole, and boiler plate floor, has taken the fun out of sanitary engineering.

Who can laugh at a plugged septic tank or a million dollar property that health authorities have declared inadequate?

It is not surprising to find the residents of Kansas City, Missouri, dragging their feet at the prospect of financing a new \$20 million sewage treatment plant. Having failed to meet a September 1959, deadline for balloting on a bond issue, the Missourians are now subject to legal action by the U. S. Department of Justice. No one, including Arthur S. Fleming, knows just what this means.

The packing industries in the area have asked that they be permitted to build and operate their own waste disposal system. They say they can do it better and cheaper with a million dollar lagoon system, and L. R. Howson, from the Chicago consulting engineering firm of Alvord, Burdick & Howson, says he has the facts to prove it. The Kansas State Board of Health disagrees. It is blocking the plan — mainly because Kansas City hopes to get \$375,000 a year in service charges from industry, when and if it gets the new sewage treatment plant.

While Kansas City industry feels it is being forced to carry too much of the sewage treatment burden, Indianapolis public officials are concerned over the fact that industry is being subsidized. Based on preliminary studies at several plants, it is apparent that what industry pays in taxes does not even approach what it costs to treat its wastes.

On the home building front, the Michigan State Health Department has promised to lift a building ban in Wayne County, just as soon as construction plans for a \$30 million sanitary sewer system are completed. Building was halted in June 1959, because of a lack of sewer and treatment facilities.

These examples of public apathy and irresponsibility are not uncommon. The Public Health Service states that nearly 2900 new treatment plants are needed in communities now discharging raw sewage. Some 1600 plants should be enlarged or improved. One out of every three sewage plants in operation is inadequate. The national backlog of needed municipal projects amounts to \$2 billion, and it would take an annual expenditure of \$600 million a year to wipe out this backlog.

Success on the Ohio

There are some bright spots. The Ohio River Valley Water Sanitation Commission has made great



Pittsburgh Sewage Treatment Plant of the Allegheny County Sanitary Authority was designed by Metcalf & Eddy, consulting engineers, Boston. Link-Belt Company

mechanical equipment was specified for the 150 mgd plant which serves Pittsburgh and 60 surrounding communities. Primary treatment removes 50 percent B.O.D.

strides since its creation in 1948. Just over a decade ago, the Ohio River was everybody's sewer. Less than one percent of the 3½ million people along its banks were served by treatment plants. Today, treatment plants are serving, or are about ready to serve, more than 95 percent of this population.

The high spot in the Commission's history was the completion of the \$100 million Allegheny County Sanitary System, for the Ohio had been burdened at its very source with the pollution created by 1.4 million people! Downstream, progress also has been good. Marietta, Ohio's treatment plant cost \$120 per capita; Parkersburg, West Virginia's \$100; and Cincinnati has invested \$60 million to protect Louisville, Evansville, and Paducah. There are some failures — Huntington, West Virginia; Martins Ferry, Ohio; and Cairo, Illinois are notable because of their size.

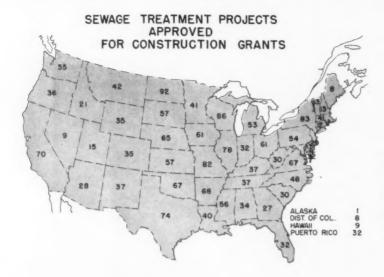
Fish still have a tough time of it on some stretches of the Ohio, but they are coming back. Commercial fishermen are back in business and have agreed to keep records for the Commission. Other studies are being carried out on a continuous basis, and the River has become a laboratory for the study of water pollution.

The Commission has just announced the successfull development of its ORSANCO Robot Monitor.

This new device will make the Ohio Valley the first river system in the world to be placed under constant vigilance for water quality protection. Ten different qualities will be tested at 40 locations. A telemeter receiver is connected by telephone line to analyzers along the river. At specified intervals the monitor stations are called for a report which is automatically transcribed on a tabulation sheet. Thus, the Ohio River is not only being cleaned up, it is being kept clean!

Treatment Plant Construction Lags

In recent history, sewage treatment plant construction has kept pace with needs for only one brief period — during the Federal public works program of the depression ridden '30s. The Federal government got into the act again just four years ago with Public Law 660, or the 1956 Water Pollution Control Act, as it is popularly known. This law makes Federal incentive grants available to assist cities, towns, and villages in the building of local sewage treatment works. The grants, with an annual ceiling of no more than \$50 million over a 10-year period, pay up to 30 percent of construction costs or \$250,000, whichever is less. To date, grants to 2156 communities total \$180 million and support projects costing \$1044 million.



The 1956 Water Pollution Control Act has boosted annual expenditure for sewage treatment plant construction to over \$350 million. To date, grants totalling around \$180 million have been made to 2156 communities, supporting \$1044 million in projects.

While these grants have been small in terms of the flood of Federal money for public works to which we have become accustomed, they have had a tremendous impact. In the five years prior to the availability of these funds, construction was dragging along at an annual level of \$222 million (1952-56). It has now zoomed to over \$350 million. But the need is for a rate of around \$600 million, exclusive of costly collection sewers or industrial treatment. Thus, though the Public Health Service reports that the impetus of the grants has resulted in a total stream cleanup of 21,000 miles, current needs still are not being met.

The Water Pollution Control Act

Unlike the highway program, the pollution control act has created no controversy. After extensive hearings this year and last, Congress was so impressed by the tangible benefits of the grant technique that a bill was sent to President Eisenhower raising the annual appropriation almost two-fold to \$90 million. The bill was vetoed by the President, and although proponents waged a vigorous battle to override, they were unsuccessful. The original \$50 million annual appropriation still stands.

Consulting engineers generally concede that the Public Health Service has tried hard to administer the grants program with a minimum of red tape. State and municipal officials seem to concur, and complaints have been few. Probably basic to this pleasant relationship is the fact that the Public Health Service has recognized that grant sponsored projects are strictly local.

The PHS policy has avoided any disruption in the normal way a public project is handled by a community. An application for Federal aid is filed with the state water pollution control agency. If approved, in competition with other applicants, the application is forwarded to a Public Health Service regional office for review and tender of a grant offer. Then, the grantee must receive Federal endorsement of project plans and contract awards. Payments are made following interim inspections by Federal engineers. State pollution abatement agencies will provide detailed information and application forms. Most states allocate grant funds in the fall, although some approve applications throughout the fiscal year.

Other Federal Aid Programs

There are three other Federal programs that could influence the construction of waste treatment facilities—though on a very limited scale. Under Public Law 560, the Housing and Home Finance Agency is authorized to make interest-free Federal planning advances; emergency sanitation equipment can be purchased with Federal contributions from the Civil Defense Administration; and under Public Law 345, the Housing and Home Finance Agency is authorized to make interest bearing facility loans.

Federal money is being well spent on sewage treatment facilities because practically all of the projects are being designed by consulting engineers. There is no evidence of misuse or waste of funds, and currently each Federal dollar is backed up by nearly five local dollars. There is little chance that this money will be absorbed by mushrooming departments of government employed design engineers — unlike the Federal highway program where socialized engineering is costing the taxpayer millions of dollars.



Sewage Treatment

The Evolution of the Art

There is evidence that the newest and, where applicable, often the best method of sewage treatment is the stabilization lagoon. It requires no machinery and no chemicals — and practically no attention. It simply permits the development of fundamental biological processes which stabilize human and many organic industrial wastes.

The stabilization pond reaffirms the principle that, "What man can do well, Nature can do better." But Nature sets its own terms. With the sewage stabilization lagoon, the price is space. An upper limit of around 400 people per acre means that low cost land is essential to the use of lagoons

for sewage treatment.

Some exponents of the stabilization pond now are seeking methods of mechanizing them to reduce the acreage required. Initially, this will lead to a successful reduction in size. Ultimately, it can only lead back to a highly mechanized plant closely resembling current sewage treatment practice.

Thus, the cynical sanitary engineer has some grounds for the statement that there has been nothing new in sewage treatment for 25 years. But the practice of sanitary engineering is itself one of the newest fields of engineering. The water closet was invented in 1778, and it was many years before it became widely accepted.

Hamburg, Germany built the first comprehensive sanitary sewer system in 1843. It dumped into a river, and provisions were made for a weekly flushing. A similar system was begun in Chicago in 1855. In 1857, Brooklyn began discharging its sewage to tidewater.

London admitted sewage into its storm sewers in 1815, Boston in 1833, and Paris in 1880. London ultimately turned to a combined storm and sanitary sewer system, and by 1864, the discharge was being delivered to a tidal river at a point some 14 miles below the city. As late as 1878, Paris had over 124,000 cesspools and other receptacles which were cleaned at irregular intervals by contractors. When Paris finally turned to a separate sanitary sewer, it also turned to disposal by "sewage farming." By 1923, 12,500 acres were being irrigated this way.

The disposal of sewage on arable land is an ancient solution, and it persists in many parts of the world today. It was first attempted in the U.S. at the State Insane Asylum, at Augusta, Maine, in 1872. Today, it is still in use, particularly on the West Coast, but only the sewage effluent is used. Its treatment prior to use for irrigation is carefully controlled to meet rigid standards.

By 1889, the city of Worcester, Massachusetts, had a chemical precipitation plant designed in accordance with discoveries made at the Lawrence Experiment Station. Iron compounds were used to precipitate solids, leaving a fairly clear liquid. The drying of sludge in open beds came in 1891, and by 1894 the trickling filter had been introduced. Thus, modern sewage treatment methods are actually about 75 years old. The data accumulated from operation of the early New England plants is still faithfully recorded in textbooks and manuals on sewage treatment.

In the early years before the establishment of the London and Paris sanitary sewer systems, cholera was the stimulus that forced sanitation progress. Epidemics struck both cities in 1832, and London

suffered again in 1849 and 1852.

It was typhoid that forced Chicago to act. At the turn of the century, that city adopted the rather simple expedient of digging a drainage canal to the Illinois River and using some 10,000 cubic feet of water per second from Lake Michigan to flush its sewage into the river system. The pollution of the Illinois and the reduced flow for power purposes at Niagara brought national and international reaction. The disagreements dragged on until the Supreme Court ordered Chicago to reduce its lake diversion to 1500 cubic feet per second in 1938.

This forced the city into sewage treatment, and three treatment plants were built at a cost of over \$300 million. The activated sludge process, well known but rarely used, seemed the logical choice for Chicago with its combined sewer system, which would send both sanitary and storm discharge through the new plants. It was a bold step, and Chicago took it. Many other new concepts have



Some of the effluent from the Indio Sanitary District plant is used for irrigation on District owned land which is leased to a farmer. The effluent is of excellent quality and complies with requirements of the Water Pollution Control Board of California. Plant was designed by the Los Angeles firm of Koebig and Koebig. It includes a bar screen and two circular primary clarifiers, with primary effluent flow being divided between a high rate trickling filter and a 14 acre, 4% foot deep oxidation pond. Flow to the pond is distributed between two entry points and is removed by two weir boxes at the opposite end. The plant has a design average flow capacity of 3.75 mgd and can be easily expanded to meet future load increases.

Plant effluent at this plant, owned by the City of Fresno, is conducted via concrete lined canals to the municipally owned and operated sewage farm where it is used for irrigation. Principal product of the sewage farm is cattle which are fed on crops irrigated by the effluent. Excess effluent is percolated into the ground or given to nearby farmers for irrigation of their own lands. This Koebig and Koebig designed plant has an average flow of 24 mgd consisting mainly of domestic sewage, although a heavy load of winery wastes is handled in the fall. The gravity plant is equipped with two, 4 foot Barminuters, mechanically cleaned grit chambers, and circular primary clarifiers. The raw sludge is digested in five heated digesters and dried on open sludge drying beds.



been investigated in the City's treatment plants. They currently provide for a population of over 4 million and handle industrial wastes that add the equivalent load of another 3 million people.

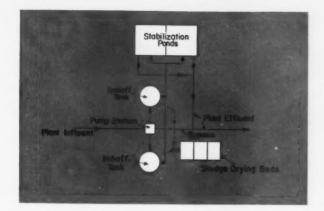
Since the turn of the century, sewage treatment has taken many twists and turns. In 1918, Mount Kisco, New York, was a village of 3000 situated on a tributary of New York City's Croton River water supply. To prevent contamination of New York's water, a plant was built to process the village sewage. No expense was spared, with sewage passing through a septic tank, filtered, and then disinfected with chlorine. This was the latest thing in 1918, but except for individual residences, the septic tank today is obsolete. The poor quality of the effluent is no longer tolerable.

The next step was the Imhoff tank, and while it was a great improvement over the septic tank, it required care in operation to eliminate odor, and

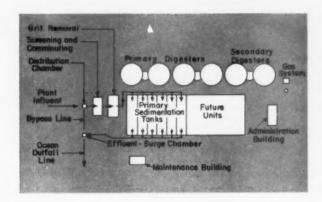
nuisance problems. It still is used in small plants today, sometimes designed so that it can be converted to other uses as the plant expands. In one plant, the Imhoff tanks are of circular design and will be converted to sludge digesters.

Primary Treatment Not Adequate

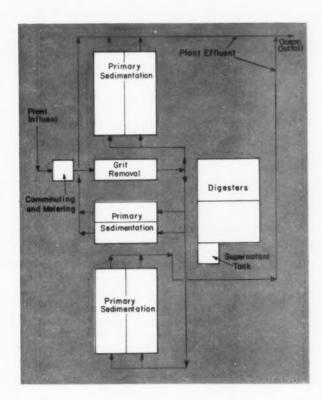
These advances in primary treatment have been mostly in the area of solids removal and sludge digestion. But primary treatment – through sedimentation – leaves much to be desired, except where there is ample opportunity for dilution in large rivers, lakes, or oceans. It is conceded that plain sedimentation can remove only one third of the B.O.D., whereas chemical precipitation can remove from 65 to 70 percent. However, the use of chemicals for this purpose has an erratic history. They were used before 1900 in the U. S., and the idea dates back to 1740 in France. About 1929,



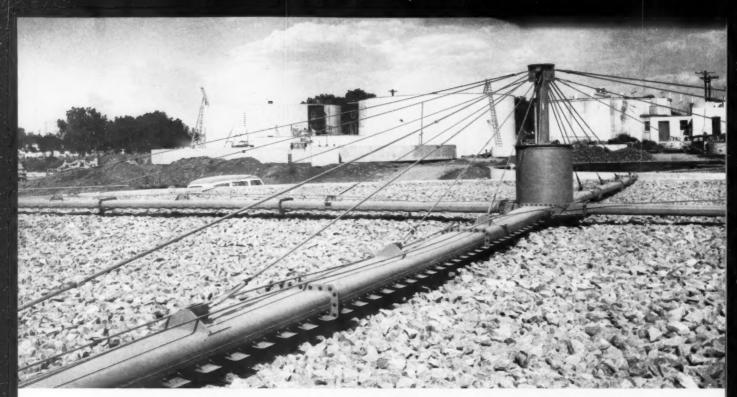
Henderson, Nevada, has a new plant with Imhoff tanks designed for future conversion to sludge digesters when expanded loads make it necessary to convert the plant to a trickling filter system. The circular Imhoff tanks have an inside diameter of 45-ft and a sidewater depth of 24-ft. Capacity of the tanks as primary clarifiers is 1.5 mgd or a population equivalent of 15,000. Oxidation ponds provide secondary treatment of the flow prior to discharge to seepage basins. The plant was designed by James M. Montgomery, Pasadena consultant.



Holmes and Narver, Inc. designed the San Diego treatment plant in a joint venture with James M. Montgomery. The entire \$45 million project involved 20 miles of interceptor sewers, two major pumping stations, a primary treatment plant, and a 102-inch diameter ocean outfall which will discharge treated effluent to the ocean at a depth of 220-ft and a distance of 13,000-ft from the shore. Separate sludge digestion will be handled in six, 125-ft diameter concrete tanks, reported to be the largest digesters in the U. S. The project will serve a metropolitan area of 410-sq miles and an ultimate population expected to total almost 3 million people.



Another James M. Montgomery project was the remodeling of the Laguna Beach, California treatment plant and the design of a new ocean outfall. The latter consists of a 27-inch diameter land section 1800-ft long, and a 30-inch submarine section 3100-ft long. The treatment plant, formerly designed for the activated sludge process, has been converted to a primary plant, with secondary clarifiers converted to primary clarifiers. The plant now has a capacity of 4 mgd average and 8 mgd peak. This is more than double the original capacity. The outfall will meet local needs until 1995.



Trickling filter and two digestion tanks in the background are part of treatment plant additions for the City of Littleton, Colorado. The \$460,000 project, designed by Dale H. Rea, was financed by revenue bonds, with Federal aid of about \$65,000. Dorr-Oliver clarifier

and filter equipment was specified, and sludge digestion and gas utilization equipment was furnished by the Pacific Flush Tank Company. Plant capacity will meet the sewage treatment needs of a population which is expected to rise from 12,000 to 20,000 people.

there was a resurgence in their use here, but they have now gone out again. New developments may change this, for high molecular weight polymers (such as Dow's Purafloc) are being studied in both water and waste treatment with promising results.

Secondary treatment involves the use of biological methods following primary treatment by sedimentation. The trickling filter and the activated sludge process are the principal aerobic methods. They are used in an extreme variety of combinations, with patents covering various processes which often seem different in detail but basically similar. The advantages of the trickling filter are simplicity of operation and ability to take shock loads, but the activated sludge process is becoming so versatile that it dominates the large plant field.

In 1945, in the U. S., there were 324 activated sludge plants serving 11½ million people. By 1957 there were 589, serving almost 25 million — over half of the sewage receiving secondary treatment was treated by the activated sludge process. Still, the small plant is apparently best served by the trickling filter, for in 1957 there were more than four times as many plants using this process as there were using the activated sludge process.

The activated sludge process uses considerable mechanical equipment, has higher operating costs,

and requires more skilled operators. It also tends to create large quantities of high moisture sludge. However, versatility in the reduction of solids and B.O.D., the production of clear effluent, high efficiency at low air temperatures, and the elimination of odor nuisance easily offset the disadvantages.

Out of the activated sludge process has evolved a number of processes using large quantities of air. Terms such as "super aeration," "wet combustion," and "total oxidation" describe these processes. Ostensibly, the organics are "burned up" in an aeration tank, and large settling tanks are not used. These processes have been used primarily with small plants, being offered in packaged units. They are cheap to buy, but expensive to operate.

Sludge Digestion

Progress in sludge processing has centered around the control of digester temperature, the concentration of sludge to conserve space, and the use of gas recirculation and mechanical mixing to insure rapid and uniform digestion. It is possible to simply avoid processing the sludge at all. The development of the coil spring type filter media for vacuum filters has spurred this approach.

There are now almost 50 sewage plants in 14 states dewatering fresh sludge. The types of fresh

sludge include primary only, primary and trickling filter, primary and garbage, chemical precipitation, chemical precipitation and activated sludge, chemical precipitation and trickling filter, and activated only. Disposal of the filtered sludge is by incineration, land fill, or farm use.

Although there has been some concern over the problem of disease hazards, the filtering of raw sludge has been practiced since 1925. More study is indicated, but current evidence shows that with chemical conditioning there is no serious bacterial problem. Compared to other sludge treatment, the installation costs of vacuum filters for raw sludge are low, they operate at about the same economic level as other processes, and odor is no problem.

Whether sludge is digested or fresh filtered, there remains the problem of disposal. The economic value of a particular sludge for use as a fertilizer is open to question, and there are some rather strong opinions pro and con about municipalities going into the fertilizer business. Some seem to have done so profitably. Baltimore even has installed a recently developed Allis-Chalmers compacting process to improve the physical characteristics of its heat dried sludge, which is sold to several companies using it as a base for fertilizers.

The AST Process

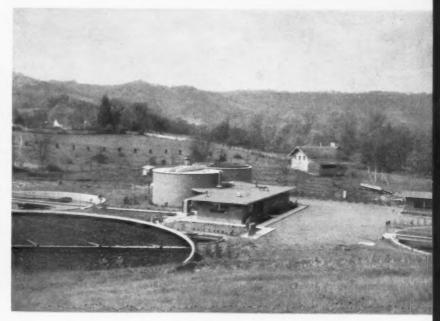
Since most plant operators agree that getting rid of sludge is a problem, eliminating it without putting it in solid form seems to be the best solution. So far, the problem has been one of trying to reduce the operating costs created by high heat demands.





Covered trickling filter and insulated masonry digester walls are features of the Luverne, Minnesota, sewage treatment plant. Design and supervision of construction was provided by the Stanley Engineering Company of Muscatine, Iowa. Plant was designed for a capacity of 0.5 mgd, but is readily expandable.

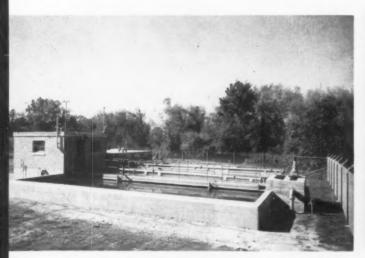
A high rate trickling filter was included in the Roseburg, Oregon, plant design by Cornell, Howland, Hayes and Merryfield, Corvallis, Oregon, consulting firm. Pumps discharge sewage to grinding facilities and then to an aerated clarifier. Effluent goes to the filter and is recirculated back over the filter before passing through a final clarifier on its way to the plant outfall. Sludge from the primary clarifier is pumped through a Dorr-Clone which removes the inorganic matter before it passes to a sludge thickener. Two stage digestion is used, with the primary digester tank equipped with a draft tube type mixing unit which contains a hot water jacket functioning as a heat exchanger. The secondary digester has a gas holder type floating cover. A sludge gas engine generator set provides power for peak loads. The treatment plant can handle a population load of 20,000.





Based on a conventional activated sludge flowsheet, the Choccolocco Creek Sewage Treatment Plant serving Anniston, Alabama, was one of the first to incorporate the Dorrco Densludge digestion system. It was designed by Poglaze & Bosenberg, Birmingham consulting

firm. Serving a design population of over 58,000, the plant includes four 74-ft square clarifiers, two Dorr thickeners, two 60-ft diameter digesters, and one 60-ft diameter storage tank with gasholder. Operations began at the plant in 1958.

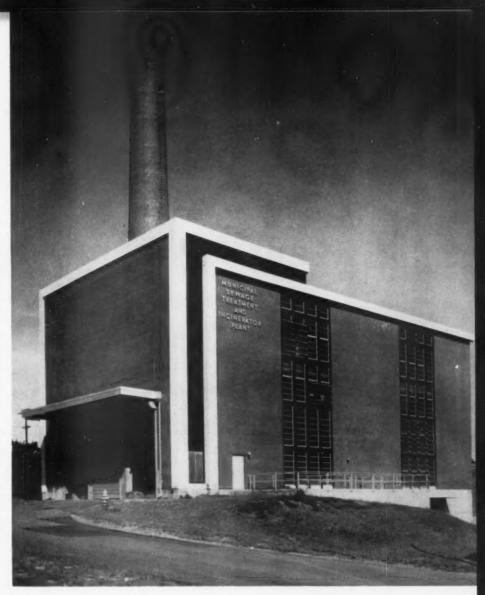


When completed in 1958, the Village of Orion treatment plant was the largest in the State of Illinois using the principle of extended (modified) aeration. Plans and specifications were prepared by Beling Engineering Consultants of Moline, Illinois. Continuous, 24 hour per day, aeration is not new, but in Illinois only relatively small plants had been approved. Equipment at the Orion plant includes two prefabricated lift stations furnished by Zimmer & Francescon, four Western Machinery Company raw sewage pumps, one Worthington Pump and Machinery Corporation comminutor, two



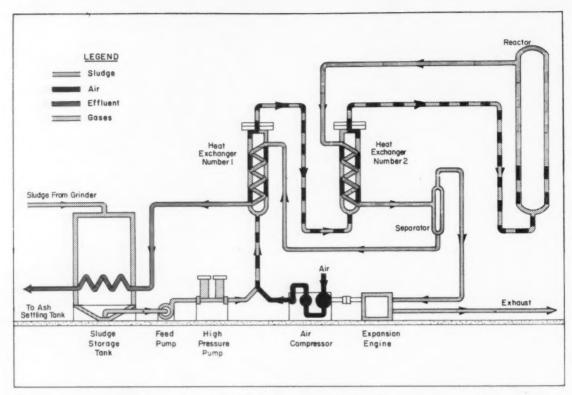
Sutorbilt Corporation air compressors, and aeration and sludge collection equipment by Walker Process Equipment, Inc. An interesting sidelight on the Orion plant was the fact that before it could be built, a sanitary district had to be formed. General obligation bonds were then issued to cover the \$114,075 cost of the treatment plant, and the Village was able to sell enough revenue bonds and general obligations bonds to meet the \$201,494 cost of the collecting sewer and interceptor system. Once underway, the entire project was completed in just 12 months.

Early this year, the City of New Albany, Indiana, placed in opera-tion a disposal plant for the dual disposal of both mixed refuse and sewage sludge. It was part of a \$4.2 million program of sewage improvements which included a new primary treatment plant with an average influent flow of 6.13 mgd. Consulting engineer was the Chicago firm of Consoer Townsend & Associates. Plant sludge filter cake is reduced to approximately 8 percent moisture content in a C-E Raymond flash drying system. No cost heat is supplied by two 80 ton daily capacity refuse incinerators using Combustion Engineering traveling grate stokers. The mixed refuse incinerator located at the sewage treatment plant will permit substantial savings because sludge drying or incineration heat is provided by the waste gases from the burning of the town's supply of mixed refuse.





Digested sludge flows by gravity to two Komline-Sanderson coil filters at City of Binghamton, New York, treatment plant. Parsons, Brinckerhoff, Hall & Macdonald was the consulting engineer. Each filter will have a capacity of 1400 lbs per hour of dried sludge. Total plant output is expected to be 70,000 lb per week which can be handled by a single filter in 50 hours of operation. Thus, ample capacity is available should it become necessary to filter raw sludge. Filter cake will be carried by Hapman conveyor to containers which will be hauled away each day.



Zimmerman Process flow sheet. Patents are held by Salvo Chemical Corp., a subsidiary of Sterling Drugs Inc.

The Atomized Suspension Technique, patented by the Pulp and Paper Research Institute of Canada, is currently under test at Beaconsfield, Quebec, where the system serves a population of 12,000. Settled sludge is concentrated to approximately 10 percent solids and collected in a storage tank. After passing through a disintegrator to chop up fibrous materials, it is pumped to the top of a reactor tower. Here it is atomized with pressure nozzles and passed into the tower.

Wall temperatures in the tower range from 1400 F at the top to 1000 F at the bottom. Thus, water in the spray flashes into superheated steam, and solid particles dry so rapidly as they fall that they are easily burned to a dry, fine ash when low pressure air is introduced near the tower bottom. Odors and bacteria are completely destroyed by the high temperatures. A condenser cools the steam, and the ash is carried away entrained in the condensate.

The Beaconsfield AST unit, which was installed at a cost of \$35,000, occupies a ground area of only 40 square feet. It has electric heating elements in the insulated reactor tower, a tube only two feet in diameter and 20-feet high.

No provision has been made for recovering the heat wasted in the exhaust steam from the reactor.

This would be recoverable for some useful application and might reduce what appears to be a rather costly method of heat production.

It is probable that the AST concept will be more adaptable to industrial wastes than domestic, for some engineers feel that the cost of creating the high temperatures will be prohibitive. It should be remembered, too, that Canada's hydro-power is available at government subsidized rates.

The Zimmerman Process

The Zimmerman Process Oxidation Plant will shortly be on stream at Chicago, after a one-year pilot plant study. The contract for construction will be nearly \$12 million for a 200-ton a day (dry basis) plant. Equipment used in the process includes a reactor, air compressor, heat exchangers, sludge pumps, and an expansion engine.

Pumps introduce concentrated sewage sludge and air into the system in a selected ratio. The sludge is preheated in the heat exchangers to about 400 F, so that oxidation can start with reasonable speed, and it then is forced into the reactor. The temperature in the reactor can be run up to 700 F, the upper limit being the critical temperature of water (the point at which water in a liquid state

One of four large reactors being installed at the West-Southwest Treatment Works of the Metropolitan Sanitary District of Greater Chicago. Each reactor weighs 160 tons, is 65-ft high, rests on an 8-ft high base, and has a capacity of 50 tons of sewage sludge (dry weight) per day. Reactors are the heart of the Zimmerman Process which has been laboratory tested by the Chicago District for a one year period.

cannot exist regardless of pressure). At temperatures below 400 F, oxidation appears too slow for practical application although complete oxidations have been carried out as low as $300\ F$. Normal reactor temperatures are near $500\ F$.

Contents of the reactor move forward continuously to the first heat exchanger where some excess heat is removed to preheat incoming sludge. Next, the contents are separated in a steam separator into gas and water. This water is used further to preheat the incoming sludge. Ultimately its heat is exhausted in the storage tank heater.

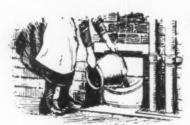
The liquid contains the ash, which can be pumped to a lagoon or fill. Containing no more than 10 to 15 percent organic matter, depending upon the degree of oxidation desired, the ash will not create obnoxious odors. The gases previously separated then are expanded to run a directly coupled air compressor.

A key factor in the Zimmerman process is the concentration, i.e., percent solids, of the sludge fed to the reactor. If sludge concentration is high enough, the reaction is self-sustaining and may produce a surplus of heat energy. If sludge is too dilute, heat energy may have to be supplied to keep the reaction going.



This sewage stabilization lagoon system for the South Suburban Sanitary District of Klamath Falls, Oregon, was completed in 1959. Designed by Cornell, Howland, Hayes and Merryfield. the lagoon system is composed of four ponds covering 120 acres. The ponds may be operated in either series or parallel. Total cost of the lagoon project, including the raw sewage pumping station, was \$225,000. The land cost was \$70,000, and the system is designed to serve a 20,000 population.





Sewage Treatment

Lagoons ... Natures Way

Though the Public Health Service has not officially promoted the construction of waste stabilization lagoons, they make up a surprising 20 percent of all approved projects under Public Law 660. To date, 434 lagoons in 29 states have received approval. A total of over 1000 are now in operation, with the heaviest concentration in the Midwest.

In the United States, the stabilization lagoon idea was first used in the Southwest. San Antonio is reported to have used lagoons as early as 1901. In Santa Rosa, California, a clogged sewage seepage gravel bed made possible the first observations of photosynthetic stabilization in that State in 1924. The Texas and California experience brought favorable reactions, and there are now more than 250 installations in the Southwest. However, Texas requires primary treatment, and the acceptance of raw sewage lagoons anywhere in the Southwest has been relatively slow.

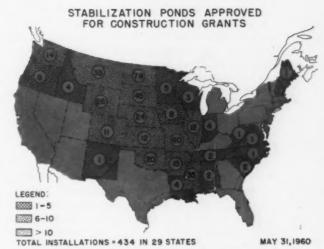
Use of stabilization lagoons is not confined to the U.S. Much research has been done abroad, particularly in Sweden and Germany. The four lagoons serving Auckland, New Zealand's population of 381,000 are the largest installation in the world. Grand Forks, North Dakota, has a single lagoon under construction which will serve 40,000 — the largest in the U.S. North Dakota leads the nation in number of lagoons, with 78 now in operation. According to George J. Toman, Mandan, North Dakota consulting engineer and an outstanding authority on lagoon design, it is proper that his state be ahead of the rest. Toman claims 1922 for the first ponding of untreated raw sewage in North Dakota. The location was a small community where a consulting engineer had designed a sewer system with an outfall line that emptied into a slough some distance from the townsite. It was assumed that the odor would be lost in the wide open prairies and that evaporation would take care of the liquid.

Much to everyone's surprise, the only smell that was noticed occurred for a few days in the spring when the ice was melting. Further investigation revealed that the quality of the pond water was equivalent to that of effluent from a secondary treatment plant. Subsequent observations and study resulted in State Department of Health approval of a consultant designed lagoon in 1948. It was constructed and has operated satisfactorily ever since.

Following the acceptance of ponds by the North Dakota State Department of Health, there was considerable activity in the field by consultants in the area. They were doing their own research, with strong support from J. H. Svore, of the State Health Department. They came up with ponds of various shapes and in depths ranging from 6 inches to 5 feet. Most of the original lagoons were single cell, but multiple cells in series and parallel were used.

George Toman was one of the first consultants to be convinced that the stabilization pond was an economical answer to his clients' problems. In fact, he went so far as to redesign a project in mid-construction when tentative approval for ponds was granted in North Dakota. As a result, an Imhoff tank already installed was bypassed to feed sewage into a lagoon. The Imhoff tank represented almost 20 percent of the total project cost — the pond, less than 1 percent!

In the ensuing years many lagoons were built in North Dakota, and the idea took hold in South



Public Health Service has approved Federal aid grants for construction of 434 lagoon systems in 29 states.

SEWAGE POND CONTRACT AWARDS 1952-1957 REPORTED BY U.S. PUBLIC HEALTH SERVICE

	1952	1953	1954	1955	1956	1957	
California	1					7	
Colorado			1	6	4	7	
Connecticut					1		
Florida		1					
Idaho					1	1	
Illinois			1			2	
Indiana						1	
lowa					1		
Kansas				1	1	1	
Kentucky						1	
Minnesota			2	- 1		5	
Mississippi					2	3	
Missouri			1	2	10	6	
Montana			7	2	2	6	
Nebraska			2	2	4	1	
New Jersey		1					
Nevada				1	- 1	- 1	
North Dakota	2	8	12	10	8	14	
Ohio						1	
Oklahoma					2	3	
Oregon			2	1		1	
South Dakota		2		14	8	5	
Tennessee						1	
Texas	1					- 1	
Utah						-	
Washington			1	2	3	2	
Wisconsin				- 1	1		
Wyoming		1	1	2	2	2	
Yearly Totals	4	13	30	46	51	73	

Dakota, Kansas, and Missouri is well. In cooperation with the states of North and South Dakota and Texas, the PHS made extensive studies in 1955 and 1956 to develop additional information on the design, operation, and application of lagoons for treating raw sewage.

Meanwhile, Joe Williamson, St. Louis consulting engineer, had enthusiastically endorsed the stabilization lagoon for sewage treatment in Missouri. (See Consulting Engineer, December 1956, page 42.) Currently he is investigating the effect of mechanically introducing air and recirculation into a lagoon in an effort to reduce the required acreage for treating domestic wastes. Based on experience with an Infilco aerator unit at a pond treating cannery wastes, Williamson now is planning to install a similar unit in a small pond treating wastes from a subdivision. The unit will provide approximately 4½ pounds of oxygen per hour with a 1% hp drive. It will be mounted on a raft, to compensate for variations in the lagoon water level and will be located over the submerged center inlet. Warm incoming sewage will insure an ice-free area around the raft. When the installation is operative, data will be gathered for the Missouri State Division of Health to show the efficiency of treatment. Incidentally, Missouri officials have enthusiastically endorsed stabilization lagoons. In 1957 the state published a design guide which was unequivocable in its praise.

The Kansas City Meeting

Probably no greater stimulus has been given the lagoon system than the Symposium on Waste Stabilization Lagoons, arranged by the U.S. Public

Health Service at the request of the Missouri Basin Engineering Health Council. It was held in Kansas City, Missouri, during the first week in August, and drew an attendance of well over 300 from 32 states and eight foreign countries. Papers presented at this meeting will be published in September.

Evaluating this meeting for Consulting Engineer, Glen J. Hopkins, regional engineer of the

PHS in Kansas City, pointed out that:

¶ The registration proved that even areas that have resisted the lagoon movement are now interested. One registrant, an alderman from a town in South Carolina, traveled to the meeting at his own expense because he felt the lagoon treatment of raw sewage was the right answer for his town.

¶ Data presented at the sessions proved that where properly designed, constructed, and maintained, the lagoon treatment of raw sewage can provide small communities with a system equal to or better than that provided by conventional secondary treatment. ¶ The history of raw sewage lagoons indicates construction cost reductions over conventional plants in the range of 40 to 60 percent, with an absolute minimum of operation and maintenance cost.

¶ The recent report approved and published by the Missouri Basin Engineering Health Council is evidence that sound engineering principles can be developed for lagoon design in areas having an extremely wide range of climatic conditions.

¶ Consulting engineers are showing increased interest in lagoon treatment because it has brought sewer and sewage treatment costs down to such a level that many communities never before able to afford treatment now can. In one seven-state area the number of communities treating their sewage has doubled since the acceptance of the lagoon

method. Further, public funds saved by use of lagoons in sewage treatment inevitably are spent on other engineering projects.

The Kansas City meeting proved that there is an amazing amount of scientific research already completed on the biological actions that make lagoon treatment of sewage possible. It also proved that there remains much to be done. For the engineer, there remains the task of reducing this abundance of research into a basic set of design principles. Meanwhile, the consulting engineer who undertakes the design of stabilization lagoons will do well to follow the relatively conservative approach endorsed by the Missouri Basin Health Council.

In spite of the *Reader's Digest's* enthusiastic report, public opinion is still averse to the idea of dumping raw sewage in a pond in the backyard. And the daily press is more concerned with the failure of lagoons than with their success. During the recent meeting, *The Kansas City Star* devoted twice as much lineage to a supposed pollution condition created by a nearby lagoon than it did to the Lagoon Symposium itself. However, when there are sound reasons for selling a community on lagoons, the job can be done — particularly where large savings can be demonstrated.

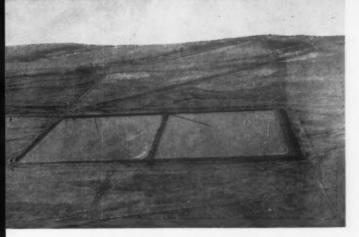
Entomologists on the Kansas City program were deeply concerned about the problems of mosquito control. When pressed, they conceded that this danger was far less than that created by the careless discharge of raw sewage. Thus, where the lagoon is the only economical answer for sewage treatment, they are enthusiastically for it — provided the weeds are kept down to prevent mosquito propagation. With proper pond maintenance, mosquitoes are no problem.



Skyway Hills, Mississippi subdivision, is served by a 7 acre lagoon designed by Franklin County Engineering Company. Maximum loading permitted by state public health officials will be about 75 homes per acre.



Forest Hill School, Hinds County, Mississippi, has running track around lagoon. Loading is held to 800 students per acre.



Aerial view of sewage lagoon at East Helena, Montana. The 15 acre system was designed by Morrison-Maierle, Inc., of Helena. Two 7½ acre cells can be operated in series or parallel. Lagoon system was constructed in 1954 at a cost of \$64,000. Present Montana regulations limit loading to 100 people per surface acre.

The consulting engineer also should be fully aware that lagoons can, and sometimes do, give off odors — bad odors. This is usually a minor problem, mostly identified with the spring break-up period in climates where lagoons ice over. Odors are mostly confined to the immediate lagoon area and are limited to a few days. In warmer climates, or in the course of unusual hot weather conditions, certain strains of bad odor algae may develop. The blue-green algae is one of these, but it can be handled rather simply. On the surface it stinks; break it up and it sinks.

In rare instances, lagoons have failed to stabilize as aerobic systems. The result has been excellent — but extremely smelly — treatment. No cases of outright failure to provide treatment have been reported, although the degree of treatment fluctuates widely in some lagoons. Poor results are usually attributable to careless design by unqualified engineers.

The Mississippi Approach

J. E. Johnston, Director of Sanitary Engineering, Mississippi State Board of Health, is one of the lagoon supporters who fought an uphill battle to achieve acceptance of raw sewage lagoons in his State. Today, there are 60 lagoons in operation and 25 in the planning or construction stage. This is a remarkable record in a state where only 20 mechanical plants existed in 1955.

This record was accomplished despite the fact that the state health authorities did not actually promote lagoons. They made every effort to dispense as much information as was available, but they never entered the local discussion until called in by the consulting engineer retained by the community. It is Johnston's opinion that state health officials should not influence a community in the selection of a sewage treatment process. This, he feels, is the prerogative of the local officials and their consulting engineer. Thus, the lagoons in Mississippi are largely consulting engineer designed installations. They have given little or no trouble, and have been widely accepted for both community and institutional use.

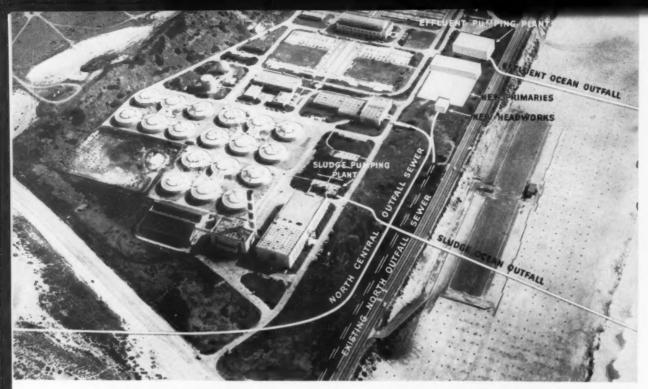
The Mississippi Society of Professional Engineers has warmly endorsed this approach. Other states have followed a similar system, and it has generally proven successful. For the waste stabilization lagoon is not just a hole in the ground — it is an engineered hole in the ground.

A conclusion to be drawn from the Kansas City meeting is that lagoons are here to stay. But early enthusiasm is being tempered with increased knowledge. As a health official commented, "Lagoons are fine, but it is a matter of some concern to note that one state has gone so lagoon-happy that not a single conventional plant has been erected within its borders in the past 10 years." Other officials expressed concern with efforts to sophisticate lagoon design. They admit the occasional need for simple mechanical devices to improve performance or reduce size, but decry attempts to load a simple pond with a maze of mechanical equipment. A number of consultants also have expressed doubt that paved lagoon bottoms, rip rap walls, and similar refinements are often justified. The supreme virtue of the lagoon is its simplicity.





Sisseton, South Dakota, lagoon was designed by Scott Engineering Company of Watertown. It was one of the first in the state and was built with an 18 and a 12 acre cell because of topography. Water level control structure is made from standard precast manhole unit. Many lagoons have been designated wild life refuges.



Hyperion Treatment Plant design average flow is 420 mgd. Most of plant power is generated by sludge gas engines.



Sewage Treatment

Big Cities . . . Big Problems

Design of large sewage treatment plants remains the exclusive province of the consulting engineer. Because of their tremendous impact on the public health and safety, they must be designed to meet rigid standards of treatment, for any pollution might affect large areas. The huge capital investment demands that plants be designed to permit future load increases, and thus be as long lived as possible. Although small plants may be equally well designed, the sheer magnitude of engineering involved in the large plant often results in excellent, if conservative, design.

One of the most thoroughly researched of recent large treatment plants was Los Angeles' Hyperion Plant, designed as a joint venture by Koebig & Koebig, Holmes & Narver, and Daniel, Mann, Johnson & Mendenhall. The design average flow for this plant is 420 million gallons per day.

Raw sewage is screened through four, 10-ft and three, 8-ft mechanical bar screens. Screenings are ground to bits and then returned to the flow. Grit removal is by Detritors and aerated grit removal tanks, with washed grit trucked away to a dump. The sewage then receives primary clarification and grease skimming in 12 primary clarifiers.

After primary treatment, the flow is split, with approximately 300 mgd going directly to the effluent pumping plant and the remaining 120 mgd going to the activated sludge plant, where a high grade effluent is produced, which then is returned to the effluent pumping plant. The combined flow is pumped five miles out to sea through a 12-ft diameter ocean outfall. There is a gravity outfall and chlorinator for emergency service.

Raw sludge is pumped to a battery of 18 heated digesters. Part of the digested sludge is elutriated,

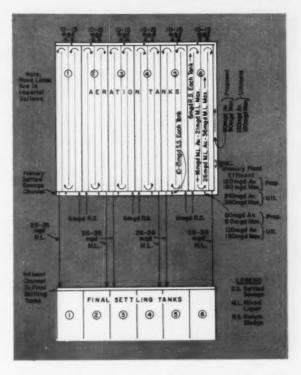
vacuum filtered, and heat dried for use as fertilizer. The balance is pumped through a 20-in. diameter outfall running about 7 miles out to sea. Most of the electrical energy at the plant is supplied by generators powered by sludge gas engines. Studies are currently under way to reclaim the 120 mgd effluent for reuse to alleviate the water shortage in the Los Angeles area.

Ashbridge's Bay Secondary Treatment

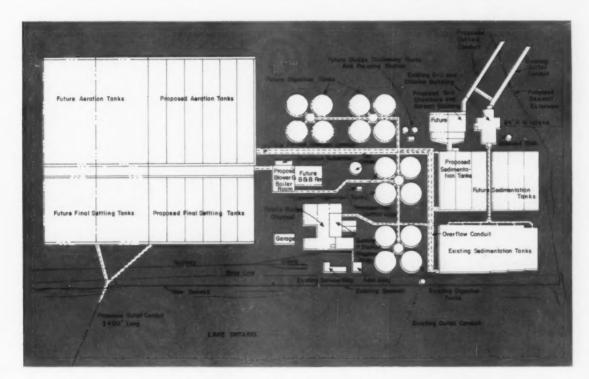
One of Metcalf & Eddy's most interesting projects is Toronto's Ashbridge's Bay secondary treatment plant, currently under construction. The project was designed as a joint venture with Gore & Storrie, Ltd., of Toronto, and will provide treatment for a design population of 1 million. Space has been allocated for expansion to provide for 2 million.

In 1959 the raw sewage averaged 240 ppm of suspended solids and 232 ppm of 5 day B.O.D. Some form of the activated sludge process was elected for the design, but extensive laboratory research preceded its final selection. It was discovered that the high rate activated sludge process would not meet established standards. However, either the conventional or step aeration process was satisfactory, and the latter was recommended.

Construction of the new secondary treatment plant is expected to be complete next year. It will



Step aeration process was selected by Metcalf & Eddy for Ashbridge's Bay treatment plant serving Toronto.



Toronto plant, a joint venture between Metcalf & Eddy and Gore & Storre, Ltd., will serve 1 million people.

include six, 4-channel, step aeration tanks capable of handling an average flow of 144 mgd and a maximum of 216. Detention period will be 3.77 hours based on mixed liquor flow. Air will be supplied at the rate of 1.2 cubic feet per gallon by 5 centrifugal blowers, each rated at 30,000 cfm at 7.5 psig, and driven by 1250-hp induction motors. Blowers are being manufactured in Switzerland.

Power for all auxiliaries and peak loads will be furnished by two dual fuel, supercharged, 6-cylinder engines connected to 1000-kw generators. The engines are of English manufacture. Cost of the aeration and final settling tanks with the blower building and equipment will run between \$9 and \$10 million. The plant's new outfall, running 2400 feet into Lake Ontario, was designed by James F. MacLaren Associates in association with Alvord, Burdick and Howson, of Chicago.

River Creates Design Problems

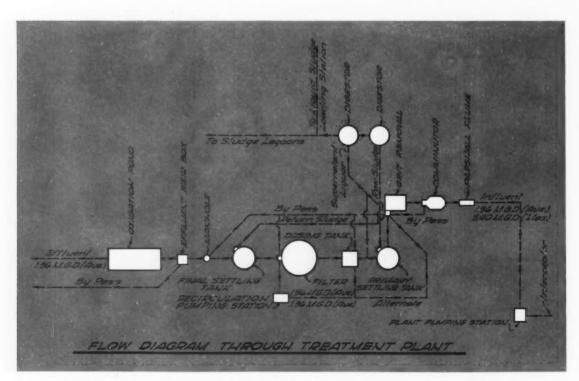
The Big Muddy River created problems for Crawford, Murphy & Tilly, who were consulting engineers for the Murphysboro, Illinois, treatment plant. The city had discharged sewage into the river through four outlets, but there was only one desirable plant site, 14,000 feet downstream from the nearest outlet. This made the interceptor 15-ft deep

at the plant, and the river was known to flood 20 feet out of its banks at this point.

The flooded pumping station problem required extensive study. Pneumatic ejectors proved to have inadequate capacity, and submersible type motors of satisfactory design for sewage pumps did not appear to be available. The solution was a modified factory made steel pumping station, specially equipped with a hatch plate which could be bolted in place when the river overflowed. Thus, the pumping station would be safe, even when the river was 15 feet above it.

Another problem created by the Big Muddy was its periodic reverse flow. Under certain conditions of flow in the Mississippi, the tributary Big Muddy reverses its flow. This could cause sewage to flow upstream to the city's water intake. This reverse flow seldom lasts for more than two days, but it may come at any river stage. This required special treatment for protection of the water supply.

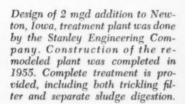
The solution was a combination oxidation-storage pond. During normal river flows the pond provides a tertiary treatment for an intermediate rate trickling filter effluent. The normal pond depth is 3 feet. When the river flow reverses, pond depth can be raised to 7 feet, providing plant effluent storage for five days at design flow.

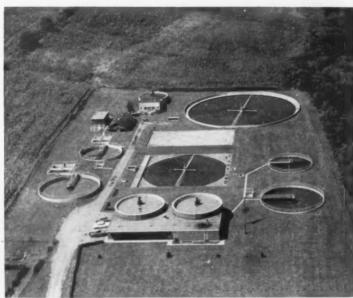


Vagaries of the Big Muddy River created problems for Crawford, Murphy & Tilly in Murphysboro plant design.



Morrison-Maierle, Inc. designed \$378,000 primary treatment plant for Helena, Montana. Installation will include screenings grinder, grit removal, primary clarifier, two-stage digestion, sludge drying beds, and control house with pumps, chlorination equipment, testing laboratory and controls.





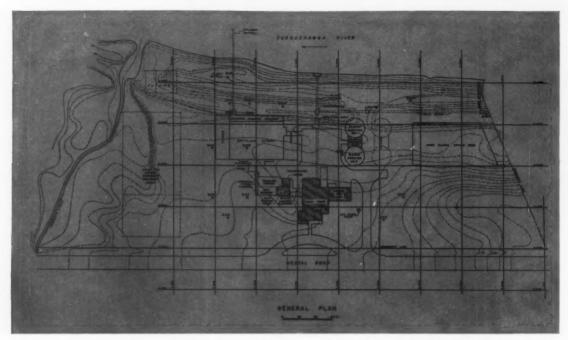
Since there is considerable variation in the loading allowed for an oxidation pond on the part of various reviewing agencies, this plant offers an excellent opportunity for pond study. The sewage load may be sent direct to the pond, it may receive all or part of the trickling filter effluent, or it may receive various combinations. Flow measurement is provided for loading condition studies.

Varying Treatment Standards

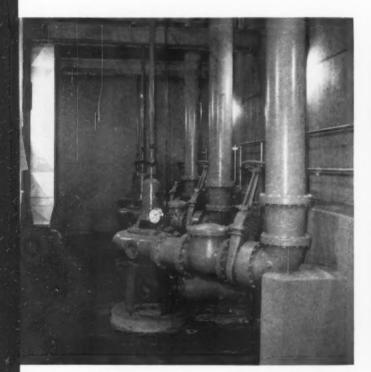
While the trend is strongly toward secondary treatment, some states still allow the construction of primary plants with just chlorination of the effluent. This is the minimum treatment allowed in Montana, and most current mechanical plants are designed for this. A typical example is the plant currently under construction at Helena, Montana, designed by Morrison-Maierle, Inc.

Construction began on the \$378,000 plant in February of 1960. It is designed for a population of 30,000. The installation includes a screenings grinder, grit removal equipment, primary clarifier, two-stage digesters, sludge drying beds, control house with pumps, chlorination equipment, laboratory, and miscellaneous controls.

Contrary to the trend toward activated sludge processing, the Newton, Iowa, treatment plant uses the trickling filter for its 3.1 mgd plant. The Stanley Engineering Company designed a 2 mgd addition to this plant which was constructed in 1955. The basic design consideration which guides Stanley engineers on such expansion programs is maximum utilization of existing equipment. Thus, many of their expansion designs are determined more by economics and required standards of treatment, than by a particular process currently in vogue.



Plan of City of Binghamton, N. Y., plant designed by Parsons, Brinckerhoff, Hall & Macdonald of New York City.



Substantial savings in plant cost were achieved at Binghamton by the use of variable capacity centrifugal pumps. Three units shown deliver raw sewage from the pump well to the grit chambers. Pneumatic water level sensing device will control motor speed.



Settling tanks at Binghamton plant. Primary treatment is sufficient because of the ample flow of the Susquehanna River. However, during the summer recreation period, chlorination will be provided. Containers in foreground are used for sludge disposal.



How One Plant Grew

The Aurora Sanitary District was organized in 1925 to collect and treat sewage from a 10 square mile area. Today it embraces a total of 34.68 square miles, serves a population of 75,000, and has an average daily flow of over 10 million gallons. The original plant, completed in 1929, was designed by Alvord, Burdick & Howson. Major alterations currently under way were designed by Walter E. Deuchler & Associates. Williard P. Pfeifer is the district's superintendent, replacing Walter A. Sperry, who retired in 1958.

The Aurora plant is a trickling filter system, with separate sludge digestion. Sewage passes through an automatically raked, mechanical bar screen before grit is removed mechanically. Remaining solids are removed in four mechanically cleaned tanks provided with facilities for removing grease and scum.

The plant was converted to a two-stage digestion operation in the mid-1930s. Five digestors now handle solids, and all are equipped for gas collection. One unit is equipped with a gas recirculation system and an external heat exchanger, but no mechanical stirring. Four of the digesters are equipped with hot water heating coils, and one of these also has an external heat exchanger. Thus, adequate provision is made for maintaining proper digester temperature.

Settling tank effluent is pumped to dosing tanks before going to the trickling filters, which are of the fixed nozzle type. Filter discharge is treated in straight line secondary settling tanks for additional solids and biochemical oxygen demand (B.O.D.) removal before discharge. In 1936 the Aurora plant abandoned the use of electric driven sewage pumps to lift the clarified effluent to the sprinkling filters. Sewer gas engines were provided to drive the two, 8 million gpd pumps. These engines are just now being replaced, and they operated at 99.7 percent availability in 1959. In 1940, all plant power requirements were met by the sewage gas produced in the digestion process. However, by the mid-1950s, standby power was required.

Major Additions and Alterations

1931 – Gas fired incinerator installed to burn screenings and grease skimmings.

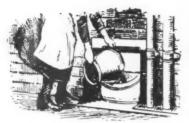
1936 – 46,250 square feet of open sludge beds installed, as well as two straight line secondary settling tanks, 110-ft by 20-ft, and 10-ft deep.

1940 – Two, 50-hp gas engines direct connected to 44-kva generators were installed to produce power and light for plant operation.

1955 – Two digesters, 50-ft square and 16%-ft deep, were installed with external heat exchangers and gas collection systems.

1957 — Gas recirculation equipment provided for one of the 1955 digesters.

Currently, the treatment plant is undergoing reconstruction work on the screen house, clarifier house, and administration building. In addition, design work is now in progress to provide additional primary and secondary settling basins to adequately process the growing load created by the district's rapidly expanding population. Meanwhile, the plant has operated continuously since 1929. In 1959, B.O.D. reduction was 85 percent.



Sewage Treatment

The Package Approach

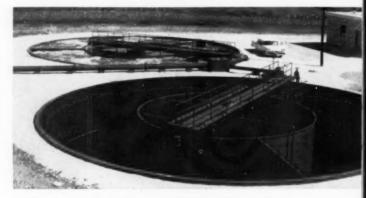
Nothing has complicated the sewage treatment problem more than the mushrooming suburban developments surrounding our cities. In the Denver metropolitan area, for example, there are 57 sanitation districts and 26 treatment plants. Only one of the treatment plants meets all state health requirements. However, bad as this may sound, it is not nearly so bad as those communities where developments have been allowed to grow with nothing more than individual septic tank service. Many fine residential subdivisions are floating on an underground lake of sewage.

The cost of a one-family septic tank can range from \$150 to \$500. Once installed it becomes a tremendous psychological barrier to the homeowner who must vote on a bond issue to finance sewers and a sewage plant. It has been demonstrated that the cost of laying sewers in paved streets may run as high as three times the cost of the same job when it is done at the time roads and houses are being built. In 1958, the cost of getting sewage to the treatment plant was runing around 80 percent of the cost of the treatment facilities themselves.

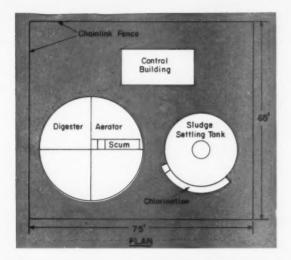
In his leaflet No. 117, "Fringe Area Sewerage Problems," published by the Florida Engineering and Industrial Experiment Station, John E. Kiker, Jr. says, ". . . it is about time that the realty developers themselves began to realize that the costs of community sewerage and sewage treatment should be considered as an inherent cost of building, comparable to that of the houses to be served. It is about time, too, that more governmental officials recognized the same thing. Many officials would do well to cooperate more with developers in working out equitable and mutually advantageous arrangements for community sewerage and treatment facilities in the fringe areas. More and better plan-

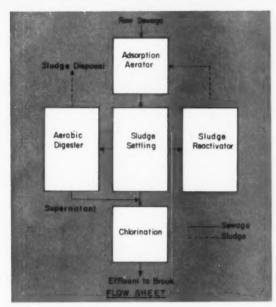


Raymond W. Campbell & Associates specified this Smith & Loveless Oxigest package treatment plant for a suburban housing development near Kansas City, Missouri. The unit will be mounted on a concrete slab.



Twin package plants at Hampton Park housing project near Joliet, Illinois. Walker Process Sparjair units are each capable of handling 5000 population equivalent with a total plant flow of 1 million gallons per day.

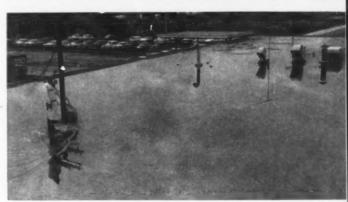




Garden State Plaza Shopping Center, designed by Abbott, Merkt & Company, was equipped with its own sewage treatment plant because local facilities were already overloaded. Working with the firm of Hazen & Sawyer, Abbott, Merkt & Company made a thorough study of the problem in an effort to meet rigid requirements of the New Jersey State Health Department. Because of high land costs, a package plant of compact design was finally selected. Dravo Corporation furnished and erected the Biological Coagulation Process plant, using aerobic digestion.

A flat roof used as an effluent evaporation pond is the unique feature of this small plant designed by Campbell Engineering, Inc. of Detroit. The owners, Automobile Transport, Inc., of Novi, Michigan, wanted a plant with minimum maintenance, but complete treatment was required. A Hays Filter Company aerated sludge plant forms the primary, with the secondary section consisting of a pump well for filter dosing, a buried sand fil-ter, a chlorine feeder and chlorine contact well, an effluent pump, and a ground level disposal pool. The latter item was bypassed when it became evident that excellent treatment was being obtained and the possibility of discharging effluent to the roof was proposed. This has been done ever since and there has been no problem with ice in winter or algae or odors in the summer. Since the roof is frequently dry in the summer, algae is killed as well as mosquito and other insect larvae. Some lime deposits have been noted, but they are not likely to accumulate to the point where removal will be necessary. Air blower for the plant was supplied by Roots-Connorsville, pumps by Kenco Submersible, and the chlorine feeder by the Fisher and Porter Company. The system has operated successfully since 1958.







David A. Evans, consulting sanitary engineer of Reading, Pennsylvania, designed and specified this plant for a school population of 1150 pupils and staff. A Chicago Pump Company Rated Aeration system was used because the site required a very high degree of treatment. Designed for a flow of 20,625 gpd, the plant includes a comminutor with bypass bar screen, an aeration tank providing 30 hours detention, a final settling tank providing 2.5 hours detention based on the daytime flow rate, a chlorine contact tank, and a V-notch weir. The blower building houses three positive displacement blowers, each rated at 112 cfm to 225 cfm at 5.0 psi; a spray pump with capacity of 30 gpm at 70-ft tdh; and one hypochlorinator. Plant cost a total of \$44,445.

ning should be done to make this possible. By far the more satisfactory method of solving fringe area sewerage problems is to connect to an existing, publicly financed sewerage system."

Unfortunately, the opportunity to tie into an existing system is not always available. In the Chicago area, where treatment facilities are being expanded to meet the needs of the growing metropolitan district, subdividers presently are allowed to build temporary sewage lagoons. One year permits are granted so that builders can proceed with a project. Sewers are installed with the local system terminating in a nearby lagoon. Later, when the area can be tied into the central system, the lagoon is leveled off and additional homes erected on the site. In this manner, adequate sewers and treatment are asured at reasonable cost, while growth of the sanitary district proceeds in an orderly manner. A similar program has been used in the Kansas City area.

There are, however, many areas where the small treatment plant is the best solution. For the consulting engineer, the small plant involves all of the problems of the large one — usually magnified many times by budgetary problems of small communities. If the apparent need is for a permanent plant it must be designed so that later additions and al-

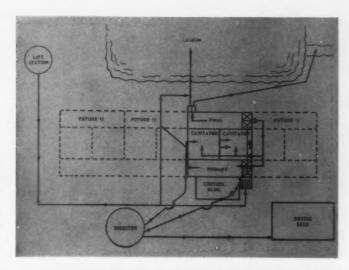
terations can be made easily and economically. If, on the other hand, it appears that the plant will have only short term utility, its initial cost must be as low as possible. Few consulting engineers have found pat solutions for these conflicting conditions.

The "package plant" approach to sewage treatment may be right for many of these communities, but this answer is not enthusiastically accepted by most consulting engineers. They have good reason to be wary. Introduced in the mid-'30s, aerobic package plants were designed primarily to cut the cost of treatment for small communities, institutions, and business establishments. The sales story frequently was full of extravagant claims of performance which simply could not be achieved in practice. As a result, public health officials became apprehensive — and many remain so today.

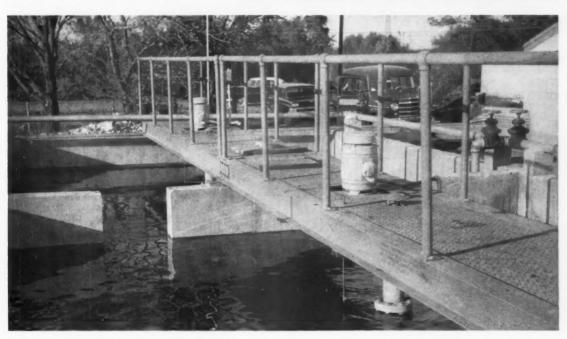
However, it is now obvious that the package plant is here to stay. The research activities of reputable manufacturers have helped, but there are still some johnny-come-lately manufacturers who are making claims they cannot substantiate.

Mechanical package plants may range in size from those for single family dwellings to those adaptable to population loads of 10,000. Teamed up, these units can be used to serve larger populations — although 10,000 seems to be a good di-

Stage construction helped to solve the sewage treatment problems of the Rolling Hills Subdivision near Tulsa. Consulting engineer J. W. Hammond, of the Tulsa firm of Hammond Engineering Co., planned a system which will grow in three stages. The first 40 homes in the subdivision were connected to a stabilization lagoon with loading set at 30 lb B.O.D. per acre. The 65,000 sq tt lagoon will continue to receive the plant effluent, even after the last stage, since the intermittent flow of Oklahoma waterways requires chlorination or lagooning. Once the capacity of the lagoon was reached, the subdivision's sewage flowed to a Yeoman Brothers' Cavitator using the aerobic di-gestion principle. When the load surpasses the aerobic digestion capacity of the plant it will be converted to conventional activated sludge processing. Sewage will flow to the primary settling tank, through the aeration tank to the final settling tank, and then to the lagoon. At this point a sludge digester will go into operation. The Rolling Hills plant began by serving 32 homes and will continue to grow until it serves 10,000. It is expected that the final cost figure will be less than \$18.00 per person served.









Robert E. Hamilton, Joliet, Illinois, consultant, designed this ranch style plant for Mokena, Illinois. Raw sludge is filtered on an 85 sq ft Komline-Sanderson vacuum filter, with the cake loaded out to farmers' manure spreaders by conveyor. Standard rate trickling filter is 40-ft in diameter and has American Well Works rotary distributor and siphon. Pumps were furnished by Aurora Pump Co. and clarifiers by Yeomans Brothers. The \$147,000 plant has a design capacity for a 3500 population, almost \$17.00 below the average per capita cost for this capacity plant — according to the figures from a USPHS survey.

viding point for large and small plants. Most of these plants are designed around mechanical aeration systems, but they are also available with high rate trickling filter systems. Their greatest area of success with public health officials has been in applications where private owners can be held responsible for their performance.

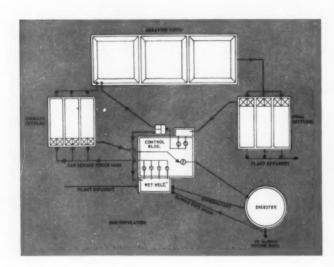
There are many consultants who remain cool toward package plants. Robert E. Hamilton, a Joliet, Illinois, consultant who has designed many small plants is one of these. While conceding that most reputable manufacturers are not bypassing the consultant and going direct to the owner with their package plants, he points out that some are. Potential, and even current, clients are being directly approached in an effort to eliminate the consultant. This is bad for the consultant in particular and the public in general.

Hamilton points out another facet of the problem which is wholly within the consulting profession. This involves the incompetent and unethical engineer who solicits extensive design assistance from the manufacturer. Such consultants have been known to use stock drawings, reproducible tracings, and detailed layouts of packaged plants, then charge the client a full design fee.

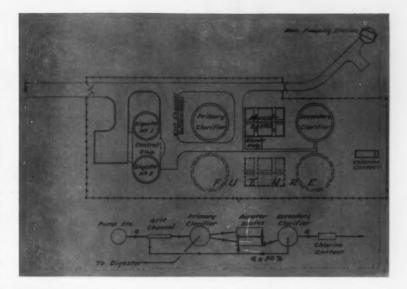
The package plant also poses a fee problem for the reputable consultant. In a purely professional sense, there can be little argument against the consulting engineer getting a full fee when he specifies a package plant. Certainly he must make detailed preliminary studies, he must select the proper plant, and his client will expect him to stand behind his decision long after the job is completed.

Some consultants take an opposite point of view. They make a distinction between being "retained" (as a professional) and "hired" (as a sort of part-time employee). When the consultants perform minimum engineering services and leave the responsibility of the package plant's performance with the manufacturer, they can — and certainly should — work for a reduced fee.

Other consultants establish their fee on the basis of the work they perform. Thus, if they are able



Glendale, Illinois, is a new community, with a future population of 6000. The new treatment plant, designed by Walter Wilson & Associates, will operate initially as an aerobic digestion system, using one aeration tank and one final clarifier. Aeration and final settling tanks will go into operation in increments of 750 persons for aerobic operation. At a 2000 population level the plant will be converted to conventional activated sludge operation. Additional tanks will then be added for increments of 2000 persons. Plant equipment includes Yeomans Hi-Cone aerators, Link-Belt settling equipment, Aurora Pump Co. pumps, and American Well Works mechanically cleaned bar screen. A heated digester of 24,000 cu ft was also furnished by Yeomans. It provides 4 cu ft per capita. Hillsboro, Washington, has a new secondary treatment plant designed by the Seattle firm of Stevens and Thompson. Basically an activated sludge plant, it will remove 90 percent of the B.O.D. for a population of 6000, with provision for expansion to serve 12,000. Air is introduced into the aeration tanks through two spargers at the bottom of each tank. Directly above are two 40 inch paddle wheels which cause turbulence and reduce air bubble size. Oxygen utilization efficiencies of 20 percent are anticipated with this Dorr-Oliver equipment, greatly reducing detention time.





has gained wide acceptance. With this approach, plants can be designed so that treatment units serving a small group of homes can be converted to other process uses and combined with additional treatment units when additional homes are built. A plant may grow in many stages without the abandonment of any of the original equipment and structures.

Another problem in the design of small plants is that of aesthetic appeal. Since these plants must be located in relatively close proximity to residential areas, appearance and nuisance elimination are important. Some package plants are readily adaptable to residential type enclosure, ranch style or split level, but many are not. Thus, custom design may be the only way in which aesthetic requirements can be met. There is also a noticeable effort on the part of small communities to get full utilization out of treatment plant structures. Some of them have combined office space, meeting rooms, and even recreational facilities with their sewage treatment plants.

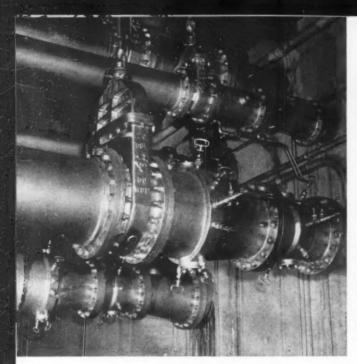
Since there is no such thing as a completely automatic and maintenance free plant, the consulting engineer often may be the only source of help when a small plant gets into trouble. Actually, the small plant, whether a package or custom design, will require occasional services of professional level. In fact, a firm already has been organized to offer this service on a contract basis. However, until this proves profitable and generally available, the consulting engineer is the small plant operator's best source of help when troubles arises. The concept of continuing — and sometimes aggravating — responsibility is the consulting engineer's strongest claim in the field of small treatment plant work.

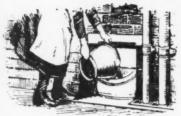
to satisfy themselves that the package plant is the proper solution without a great deal of preliminary work, they are willing to reduce their fee to match the time rather than the construction price. If the problem is more involved, the fee is increased.

It is evident that the package plant is, and will be, a thorny issue for consulting engineers. It creates an ethical problem in fee setting, and it raises the spectre of competition through engineering by manufacturers. However, many consultants feel that the problem is greatly exaggerated.

The Stage Construction Concept

Certainly, where a new plant is required for permanent service, the concept of stage construction





Sewage Treatment

Toward Automation

Roanoke, Virginia, treatment plant uses B-I-F Builders-Providence venturi tubes with manual vent cleaners and automatic backwashing on sewage and sludge flow lines. Alvord, Burdick & Howson were consultants on project.

Probably nothing has affected sewage treatment plant operation more than the introduction of adequate recording and control equipment. This, combined with research in the field of automatic laboratory testing, is bringing the automatic plant closer and closer to reality. While it is true that many package plants run without benefit of an operator, they are controlled by simple clock mechanisms which assume the regular recurrence of an expected set of conditions. The real problem is to design a plant which can automatically adjust to unexpected changes in the load, either in volume or quality.

In many instances, substitution of equipment may offer simplified methods of automatic control. For example, manufacturers of turbine type blowers claim that blast gate control permits the adjustment of rate of flow as required — with pressure remaining relatively constant throughout the blower's volume range, and with power used in proportion to volume required. Many of these units are in operation on aeration and pre-aeration tanks.

Pumps and Pump Controls

Probably the greatest progress has been made with controls for pumps. Boyd, Roper & Tsao, consulting engineer in Newark, has designed a small plant for a Sussex County school which is completely automatic. The custodian is warned of equipment failure by supervisory alarms in his office.

The plant uses two C. H. Wheeler Manufacturing Company Economy pumps which are cycled to handle flow from one or both of the plant's settling tanks. Either pump is arranged to feed either

of the two contact filters. The low speed pumps run at 960 rpm and produce a steady draw down in the wet well without surge or turbulence. Level controller and pump protective devices were furnished by the Automatic Control Company. The entire plant, serving an ultimate school population of 1000, cost only \$40,000. It was designed for a total flow of 30,000 gpd and produces an extremely high quality effluent with negligible B.O.D.

In designing the treatment plant for the new Connecticut Medium Security Prison, Fred S. Dubin Associates had to deal with both domestic and laundry wastes. A Foxboro magnetic flow meter, in conjunction with a Saunders pneumatically operated valve, maintains constant flow to the primary settling tanks and draw off from the laundry waste tanks.

When flow exceeds the design flow of 0.8 mgd, a signal from the flow meter activates the air operated valve on the recirculation line to throttle the recirculating flow to a level which reduces the primary tank inflow to 0.8 mgd. Excess recirculated flow enters a bypass to the effluent channel of the primary tank. As flow to the primary tank drops, the valve opens to hold the flow at or below the design level. Similar controls are used on the laundry tanks to control drawoff.

Magnetic clutches between drive motors and pumps also are claimed to offer many advantages, both for control purposes and reduced operating cost and capital investment. Benham Engineering Company of Muskogee and Oklahoma City has specified two of these units along with a direct connected coupling for the three raw sewage pumps

on the new Muskogee treatment plant. The direct connected pump is used as a standby unit.

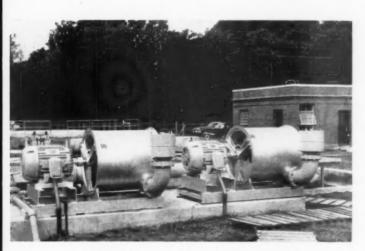
The magnetic clutches on the 4000 gpm pumps are controlled by a pneumatic system located in the wet well. They adjust the speed of the two pumps so that the flow rate of the incoming sewage is nearly matched at all times. When one pump reaches its capacity, the second pump starts operating. As it builds up to 2000 gpm, the first pump drops back to 2000 gpm. From that point, both pumps gradually speed up together to meet capacity requirements. When the standby pump is operating, it runs at full capacity, with the other two pumps adjusting to meet flow requirements.

Advantages of the system are claimed to include smooth flow for more efficient clarifier operation, single pump size to reduce spare parts inventory, reduction in total number of pumps, and a slight

reduction in power requirements.

The use of the Flo-Matcher control, essentially a water rheostat, has resulted in a number of interesting pumping station designs. Cornell, Howland, Hayes & Merryfield incorporated this type of control into the Eugene, Oregon, treatment plant which was designed in 1954.

The two raw sewage pumps at this plant are unusual in themselves because they are wet pit units with axial flow design having mixed flow impellers. The mixed flow impeller type pump has often been used to pump raw sewage, but usually with a volute type discharge. Each of the pumps has a capacity of 27,000 gpm under a total head of 10.2 feet when operating at full speed. They are driven by 125-hp wound rotor electric motors, each with a capacity equal to maximum design flow.



Massey Engineers, Fairfax, Virginia, consultants, specified Spencer blowers to deliver air at 6-lb pressure to the preaeration tanks at Fairfax sewage treatment plant.





Pumps and controls on Sparta High School treatment plant designed by Boyd, Roper & Tsao. System works automatically, with supervisory alarms inside school.

Drive motor speed is controlled by the use of a series of steel plate resistors located in a sump alongside the influent channel. These resistors are wired into circuit with the wound rotor motors. Thus, with the submergence of the plate determined by the volume of sewage to be pumped, it is possible to design the shape of the resistor plates so that the pump motor operates at a speed which will cause the pump to discharge at a rate matching the flow. In the Eugene plant, one pump operates for 24 hours, and it is then relieved by the other. This station has been in operation for five years

and has proven very economical.

A more recent Flo-Matcher installation by Ripple & Howe, Inc., Denver consultant, is going into operation at the Northwest-Western Hills Utility Company plant in Thornton, Colorado. In this plant, the design incorporates a pneumatic control system with the water rheostat so that the pumping load can be balanced between raw and recirculated sewage. Normally, the single pump (a second is planned for future expansion) will handle 5000 gpm of raw sewage and 5000 gpm of recirculated sewage. However, infinite flexibility is obtainable, since any change in the rate of flow of raw sewage will be reflected in a change in the rate of recirculation. Thus, changes in strength of sewage can be accommodated to meet state health regulations while the cost of treatment is held to an economical level.

The pump on this installation was furnished by the Aurora Pump Company. It has a capacity range from 0 to 10,000 gpm with a reduction in speed not greater than 50 percent of the speed required to deliver 10,000 gpm when operating against a static head of 28 feet. The efficiency will be 80 percent or above, and the pump is driven by a 125-hp wound rotor motor. Operating efficiency of the pumping system is expected to match a multiple pump system, and capital investment, as well as maintenance, was greatly reduced.

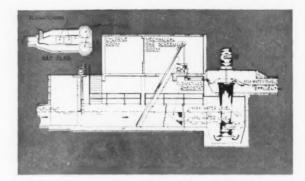
Digester Heat Exchanger

In recent years, Cornell, Howland, Hayes & Merryfield has used the digester mixer in sewage treatment plant design, both in new construction and in the conversion of existing plants. This provides a method for increasing digester output and eliminates the build-up of a scum blanket which reduces the effective volume of the digester. It also eliminates the difficulties encountered with internal digester piping resulting from settlement of a scum blanket.

Heating the digester contents without a mixer requires a circulating pump for the sludge as well as a separate heat exchanger and hot water circulating pump. The heat exchanger thus needs frequent cleaning, since the sludge in the digester is concentrated, and the sludge recirculating pump

periodically gas-binds or clogs.

The draft tubes of conventional mixers are usually 10-ft to 16-ft long, 20 inch diameter, fabricated steel pipe. The velocities and turbulence of the sludge, together with the available surface area of the draft tube, appeared to CHH&M engineers to create an ideal heat exchange situation. Enclosing the tubes in a steel jacket slightly larger than the draft tube and attaching a hot water inlet, outlet, and air vent resulted in the heat exchanger shown in the accompanying sketch. To prevent "short-circuiting" of the hot water flow from the inlet directly to the outlet, 270 degree baffles were spaced every foot, with the openings staggered. These baffles also serve as stiffeners and spacers for the shell assembly. An air trap is provided by using the upper six inches of the exchanger and



Cornell, Howland, Hayes & Merryfield specified Link-Belt mechanically cleaned bar screens ahead of Peerless Pump Division raw sewage pumps at Eugene plant.

running the air bleed line to the outside of the digester, together with piping for the hot water.

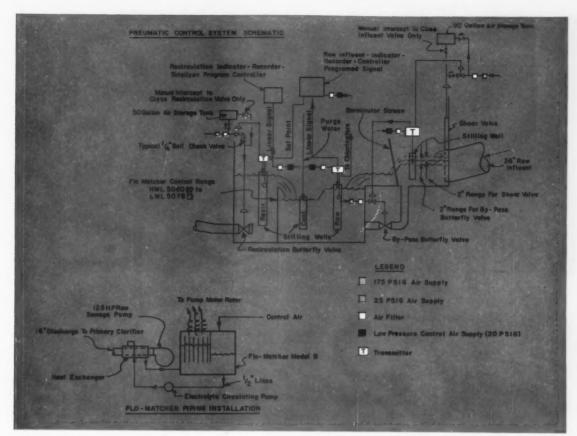
Water from a hot water boiler circulates through the draft tube heat exchanger by means of a standard in-the-line hot water circulating pump. The temperature of the water into the exchanger is maintained at 140 F, and the water leaving the exchanger is approximately 120 F. Control of the inlet temperature of the water is effected by using a mixing valve standard with any heating system control manufacturer. An immersion-type thermostat in the digester controls the hot water circulating pump. This thermostat has a narrow differential (% F to 1 F) and is provided with an interlock so the mixer continues to operate until the digester thermostat is satisfied. Where the mixer operation is controlled by a time clock, the heating system does not begin to function until the mixer runs. It then keeps the mixer operating long enough



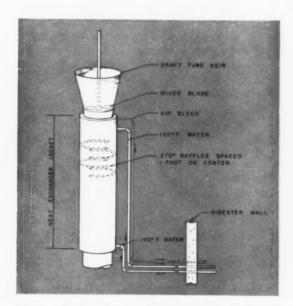
Benham Engineering Company specified magnetic clutches on raw sewage pumps at Muskogee plant. Pneumatic control system in wet well adjusts flow rate.



Flomatcher rheostat plates, showing details of immersed element that controls pump speed according to sewage depth at the Eugene, Oregon, sewage treatment plant.



Ripple & Howe piping installation and schematic of pneumatic control system for automatic raw sewage pumping.

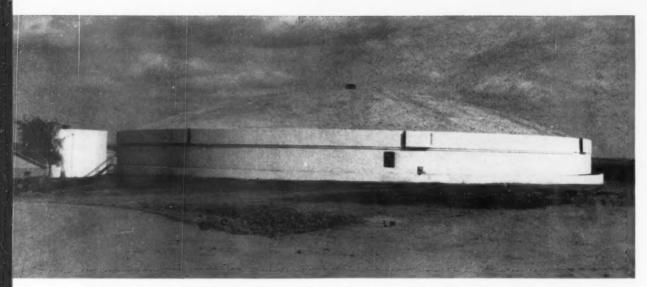


Digester heat exchanger design makes use of draft tubes of mixer by enclosing them in a steel jacket equipped with a hot water inlet and outlet, and an air vent.

to provide the heating requirement. This prevents the circulation of hot water when sludge is not moving, so the sludge is not baked to the surface.

Since this method of heating is completely new, the determination of the exchanger area has been very conservative. This is not a serious economic factor because an extra few feet of jacket represents very little cost. The area assumed for calculating the heat transfer is only the surface inside the draft tube in contact with the sludge. The heat transfer coefficient "U" is assumed to be 150 Btu per square foot per degree Fahrenheit, which again is a conservative value. It was recognized that there would also be some heat transfer from the outside surface but, since it could become caked with sludge, no account of it was taken.

Currently, CHH&M has heat exchanger designs located at Caldwell, Idaho; Roseburg and Tillamook, Oregon; and several others under construction. The surface area determinations have, in each instance, been more than adequate, and no operating difficulty has been experienced.



Prestressed dome spans 174-ft diameter General Filter Co. trickling filter at Iowa Great Lakes Sanitary District.



Sewage Treatment

Materials and Methods

Concrete for sewage treatment plants must be able to withstand exposure to freezing and thawing, wetting and drying, and mild chemical corrosion. These conditions make it mandatory that a concrete of high quality be used.

According to the Portland Cement Association, there are five important items to be considered in producing a high quality concrete:

Structurally sound aggregates of low porosity.

¶ A cement paste of low water-cement ratio.

¶ A properly designed air-entrained mix.

¶ Proper placement.

¶ Adequate curing.

Aggregates constitute from two-thirds to three-fourths of the volume of concrete. Consequently, to a large degree their characteristics influence the workability, strength, and durability of concrete. Aggregate gradation, particle shape, and surface texture are important because they affect cost, workability, segregation, permeability, and durability. Experience has shown that very fine sands or very coarse sands are objectionable. The former are uneconomical and segregate readily; the latter give harsh, unworkable mixes. In general, aggregates that do not have a large deficiency or excess of any size and give a smooth gradation curve produce the most satisfactory results.

The strength of concrete is principally dependent on the amount of mixing water used and the extent to which the chemical reactions between the cement and water have progressed. The most important single factor affecting the strength of concrete is the water-cement ratio. The lower the water-cement ratio, the greater the strength and the higher the over-all quality. The strength of concrete continues to increase as long as moisture is present to promote hydration of the cement.

Another important factor that must be considered in any discussion of durable concrete is that of air entrainment. Air-entrained concrete was developed originally to improve the resistance to freezing and thawing as well as resistance to surface scaling resulting from the application of salts to streets for ice removal. Air entrainment has served these purposes well, and also provides many other beneficial properties.

For hardened concrete it:

¶ Improves freezing and thawing resistance 10-20 times over regular concrete.

¶ Improves resistance to salt action (scaling).

¶ Improves resistance to sulfates.

¶ Improves watertightness.

For fresh concrete it: ¶ Improves workability.

¶ Reduces segregation.

¶ Reduces required sand content about 100 lbs per cubic yard.

¶ Reduces or eliminates bleeding.

¶ Finishes sooner.

¶ Reduces water content 3-5 gallons per cubic yard. Air-entrained concrete contains tiny, well distributed, and completely separate air bubbles. The bubbles range in size from 0.003 to 0.05 inches in diameter. Billions of them are contained in a cubic foot of the concrete. They serve as tiny air reservoirs and provide relief from the pressures built up by the freezing of free water in the capillaries, thereby preventing damage to the hardened paste.

It is not sufficient to have quality concrete if we forget sound construction practices. In sewage treatment plants, a major use of concrete is in tank walls. Since the walls are relatively narrow in respect to their height, a problem of placing the concrete properly can arise. If the concrete will be subject to a severe exposure condition anywhere in the tank, it will be from the water line up to the top of the tank wall. Here is where the best concrete usually is needed and where the worst often is obtained. In undisturbed newly placed concrete, the solids slowly settle, leaving a layer of water at the surface containing silt, clay, or other fines that may have been in the aggregate. This process is known as bleeding. When entrained air is present, the rate of settlement usually is reduced, materially. One method to ensure a high quality concrete at the top of the tank walls is to partially fill the forms with concrete and then finish filling with a concrete having a very low slump and water-cement ratio.

Proper curing depends upon three factors: time, temperature, and moisture. Moisture and time go hand in hand. That is, the increase in strength with age will continue so long as the concrete is kept saturated. When the concrete is permitted to dry, the chemical reactions cease. It is, therefore, desirable to keep concrete moist as long as possible.

Concrete for treatment plants should be resistant to the freezing and thawing forces of weather. If the paste is of high quality — mixed with 5.5 gallons of water per sack or less — it will be much more resistant than when more water is used.

Concrete tanks should be watertight. This requires a watertight or impermeable paste. Tests show that watertightness of the paste is dependent on the amount of mixing water used and the extent to which the chemical reactions between the cement and water have progressed. When tested with 20 psi water pressure, mortar cured moist for 7 days had no leakage when made with 5.6 gallons of water per sack. Mortar made with 9 gallons still leaked after being cured for a month.

Engineers are accustomed to designing concrete structures on the basis of concrete strength requirements, but what about durability considerations? Actually, strength and durability of the concrete must be considered together for any particular project. A check should be made on the water-cement ratio, not only for structural strength but also for durability. For resistance to weathering, the water-cement ratio should be 5.5 to 6 gallons per sack. The lower value would be for severe conditions and would include all concrete that is exposed to freezing and thawing. For exposure to sea water, the ratio should be 5 gallons per sack of cement. For watertight tanks, the ratio should be a maximum of 5.5.

For important projects, to take advantage of the utmost in economy where relatively high strengths are to be used in design, tests for strength should be made with the materials on the job and under job conditions. Such tests should include not less than three different water-cement ratios. From these tests it can be determined whether strength or durability should govern the final design water-cement ratio.

While there has been no noticeable trend toward the use of precast or prestressed concrete for treatment plant structures, both have been used. Prestressing is particularly adaptable to covered filters and also has been used effectively for filter and digester walls. Currently under construction, the Great Neck, Long Island, plant designed by Lockwood, Kessler & Bartlett, Inc., will use prestressed concrete on walls of both digesters and filters. Re-



The Little Rock sewage treatment plant project, designed by Burns & McDonnell Engineering Company, was completed this year. Major problem was the pumping station which required an excavation 55-ft deep in sand and gravel. Continuous dewatering was required during construction, since ground water was known to be at grade level. Griffin Well Point Co. dewatered site.

portedly, the largest prestressed dome in the U. S. is a post tensioned span over a 174-ft diameter filter at the Iowa Great Lakes Sanitary District.

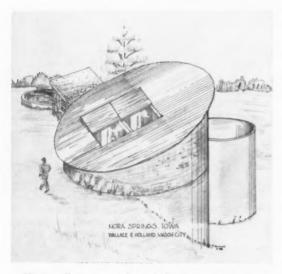
Other Construction Materials

Next to concrete, steel is the major structural component of the treatment plant. Perhaps the biggest boost to the use of steel is the development of the epoxy resin coatings. These have been developed particularly for use on small package plants, but also can be used effectively on larger structures. The coatings may be spray, brush, or dip applied after thoroughly cleaning the steel surface. Paint manufacturers, too, have taken a greater interest in designing paints particularly adapted to treatment plant applications. Fiberglass and other forms of glass and ceramic coatings also are being applied to steel used in treatment plants.

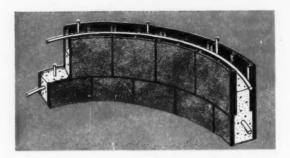
The most interesting aspect of the Carboro, North Carolina, plant designed by John R. Gove is the use of reinforced brick masonry in all structures. (Consulting Engineer, January 1960, p. 182). There has also been some application of glazed tile on industrial effluent and water treatment tanks. These units combine aesthetics with high corrosion resistance. They are, in effect, steel reinforced concrete structures faced on both sides with vitrified tile laid with corrosion resistant mortar. Provision is made in the tile for horizontal and vertical reinforcing steel, and dimensions can be varied to fit and support equipment.

Construction Must Fit Job Site

In designing the Nora Springs, Iowa, treatment plant, Wallace & Howland, Mason City consult-



Sloping filter cover admits light from winter sun.



Semco tile for tanks is corrosion resistant and designed for concrete fill with two-way reinforcing bar system.

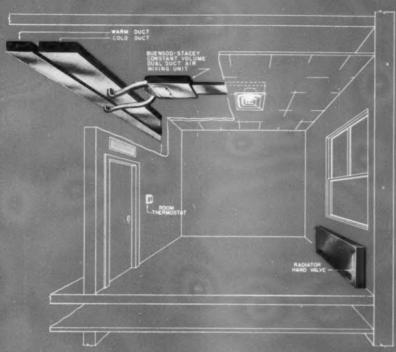
ants, encountered a number of unusual design problems. The \$77,000 plant will serve a future population of 2000. It is located on a flood plain, approximately 500 feet from high ground, in order to attain gravity flow wherever possible.

One lift station is required to maintain gravity flow at the treatment plant. It will make a 30-ft lift from a point below the adjacent river level. Mechanically controlled pneumatic ejectors are being used, with all electrical equipment mounted above the flood stage so that high water will not interfere with their operation.

Because of the flood plain location of the plant, sewage must be conveyed to it by an elevated line. This would have required either a pedestal mounted pipe or construction of an earth fill. The latter approach was used, because of the availability of fill and the insulating value of the earth. Asbestos bonded corrugated metal bituminous coated sewer pipe was used because of the hazard of dike settlement — even though fill was highly compacted.

In order to avoid the great amount of footing work which could have been required, the control house was located in a suspended position, approximately 10 feet above the surrounding flood plain. The primary tank and filter walls were used as footings.

To facilitate winter operation, a covered filter was installed. However, to provide more than mere protection from ice and snow, the filter cover will also take advantage of light and heat from the sun. The final covering structure will assume the shape of a cylinder, sliced at a 3 to 12 pitch and oriented to take full advantage of the winter sun. This sliced cylinder will be spanned with prestressed concrete beams for its full length of 44 feet. It will be covered with semiclear corrugated plastic having a light transmission of 80 to 85 percent. Corrugation openings around the extremity of the roof will be left open for winter ventilation. Hinged hatches will be provided in the roof so that summer operation will be essentially as an open filter.



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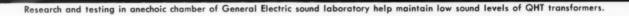
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Built-in vibration-dampening rubber cushions isolate the rugged case of General Electric QHT transformers from core vibration, main source of transformer noise.



Welded steel clamps on higher ratings of General Electric QHT dry-type transformers keep the core laminations firmly in place to minimize vibration and reduce sound.



KYA	OHT DECISELS!	MEM A STANDARD
BELOW 5	40	45
5-9	45	45
10-30	45	50
371/2-1121/2	45	55
150	45	60
167	55	60
225-300	55	62
500	60	-

[†] Measured per NEMA Standard St. 1.411. The average office has sound levels from 55 to 65 decibels.

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You can get 24 hour delivery on most models from your nearby General Electric distributor. Call him for more information, or write for GEA-6907A "QHT Specifier's and Buyer's Guide" to Section 411–15, General Electric Co., Schenectady 5, N. Y.

*Registered trademark of General Electric Co., for quiet, high temperature, dry-type transformers.

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Playne Table & Chayne ... The Early Land Surveyors

JAMES KIP FINCH, Dean Emeritus Renwick Professor of Civil Engineering Columbia University

Aaron Rathborne, English surveyor and a contemporary of Shakespeare, was one of the first to deal with land surveying, which was increasing in importance in England in the Elizabethan Period.

THERE ARE no more interesting and fascinating

CE exclusive

engineering books than those on surveying published during the two centuries that followed the in-

vention of printing about 1450. Yet, is it difficult to select from this group a single work as the one great book. It was during these centuries that new developments in the different countries of Europe led to the replacement of ancient "right-angle surveying" by more modern instruments and methods. These step by step advances were not covered in any single work, but each book of the many of the period adds its bit to the evolution taking place.

One book does seem to stand above the others in some respects. Aaron Rathborne's *The Surveyor* is not only interesting for its human qualities but, printed in London in 1616, in the midst of this period of change, perhaps it best reflects the interests and methods of the early surveyor.

In Italy problems of military surveying — the determination of the distance to an inaccessible object and the range of cannon — seem to have claimed first attention. The discoveries of the Portuguese and Spaniards stimulated new efforts in cartography and navigation. In England the movement for proprietorship and enclosure of land forced attention to land surveying. By 1616 land surveying had almost completely replaced the earlier interests of the English surveyors in military matters, and Rathborne devotes himself solely to this new field.

This Elizabethan surveyor and author, a contemporary of Shakespeare, divides his work into four "bookes" or chapters. The first two of these deal with "the Matters, Grounds, and Elements of Geometrie, . . . most fitting first by the Practicioner to be learned and well understood." Chapter One simply states a number of definitions and geometrical relationships. Chapter Two deals with a number of more practical problems in geometrical construction — how to erect a perpendicular to a given line; how to locate parallel lines; how to divide triangles . . . He also discusses graphical methods that can be carried out in the field using only distance measurements.

In the third section Rathborne notes: "This Booke tendeth chiefly to matter of Survey wherein is first described and declared the severall Instruments, fit for that purpose (with their use in practice) as the Theodelite, the Playne table and Circumferentor, whereunto I have added an absolute Instrument, which I call the Peractor, together with the making and use of the Decimal Chayne, used only by myselfe." He observes, however, "I tye not my selfe to the use of any one Instrument" and adds: "As I will not with the cunning wine taster forebeare commendations, fearing too many partners; So will I refrain wooing any to use what I much affect, further than their reason, and their owne judgement shall rule them therein."

He describes briefly the theodolite, noting that "Thomas Digges in his *Pantometria* hath made a



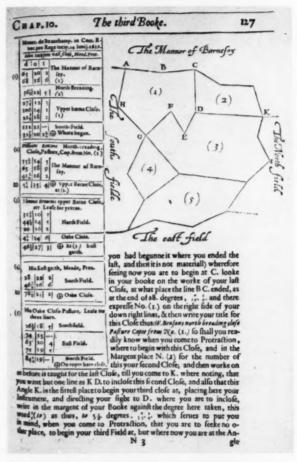
large and particular description thereof" and that M. Allen "makes these and all other Geometricall Instruments in metall." His theodolite has both the horizontal circle, or "Planisphere, whose circle is divided into 360 equall parts or divisions, called degrees" complete with an inscribed geometrical square, and the Semicircle, a vertical half circle "perpendicularly raysed." This Rathborne apparently regarded as unnecessarily complicated for "our businesse of Survey . . . by reason of the multiplicity of Divisions therein contained." Yet, his "Peractor," of which "I boldly speake and maintaine . . . that for generall use, perspicuity, speed, and perfection, it may well compare with any hitherto in use" differs little from the "verticall Semicircle" device of Digges theodolite." It would appear that these instruments were designed primarily for military measurements.

The plane table appears to have been the most widely used land surveying device. Rathborne illustrates by diagram and describes the various methods of plotting the sides of irregular fields — by angles and distances to the corners, but especially by graphical triangulation — with the plane table. "This Instrument for the playnenesse and perspicuite thereof, and of his easie use in practice," he observes, "receiveth aptly the name, and appellation of the Playne Table."

The "Playne Table" is described as a "bord" some 11 by 14 inches in size "whereunto a joynted frame is artificially applyed, for the fastening and keeping playne thereon, an ordinarie sheet of paper for use in the fields." There is no illustration of this instrument in the text but Rathborne's work falls in the period of bookmaking when elaborate decorated title pages were in vogue. The title page shows a surveyor, dividers in hand, pen in mouth, and ink bottle tied to his belt, working with this "most excellent and absolute Instrument." The sighting ruler, or alidade, illustrated is described as one of the "divers kindes used by divers men . . . the best Playne Table men favoring," Rathborne remarks, "Those of M. John Goodwyns invention, that excellent and honest artist, whose living name (though himselfe be dead) I cannot remember without good respect."

For use in "playne or levell grounds, where there is no use of reducing Hypothenusall lines," the author advises using plain sights like those on the theodolite. Where distances are measured on a slope, however, sights on the ruler should be graduated to serve as a clinometer. The front sight is thus to be provided with "a vane of brasse, to be removed up or downe" and divided like the geometrical square so that slope can be noted and "Hypothenusall or slope lines reduced to horizontall" by the use of "a table of Synes."

The surveyors compass was also coming into use, and Rathborne describes an instrument, under the name "Circumferentor," combining the compass with the slope sights of the plane table. "This Instrument," he notes, "for expedition and portabilitie, exceedeth far the rest, and nothing inferior to any for exactnesse, if care and arte be used." His compass is not illustrated but is described as "made and framed of well seasoned boxe, containing in length about eight inches, in bredth half as much



Rathborne describes "The making of a necessary and fitting Field-booke" using as an example "a survey of the Maner of Beauchampe." The survey was made by traversing with his "Circumferentor," a compass the "limbe" of which was divided into 120 divisions which, he noted, "are not the true degrees of a circle." His notes are not too clear. Under the heading "d" he records the azimuth of the sides measured in his divisions counterclockwise from the south. Headings "O" and "I" give the lengths in poles and tenths. Each field was traversed separately, and a cross-mark in a circle indicates the closing side, while a double, horizontal line sets off each traverse. The text also describes the plotting of these notes to scale with a special protractor and provides data on computation of areas by a graphical division of the plat into triangles.

. . . about the middle a round hole to be turned of the depth of halfe an inch, whereof the Diameter to be about 3½ inches, to place a card and needle therein, to be covered over with cleere glasse." The compass gave directions, while clinometer sights with a table of "synes," provided for the reduction of slope measurements to the horizontal. This was the surveyor's compass which became the standard land surveying instrument and, at least in the United States, was not replaced for this purpose by the engineer's transit, until late in the 19th Century.

Rathborne also describes another standard measuring device of the earlier land surveyor, the chain which, heavy and clumsy as it was, also continued in use until the development of steel tapes about a century ago. "For conveniencie in carryage," he advises, "an avoyding casualties often happening to breake it (though made of a full round wyer) I would advise should contain in length but onely two statute Poles or Perches, or three if you please at the most." Each pole or perch (or rod) of 16½ feet was to be divided into 100 parts. "The making of this Decimall chaine is well knowne to M. Christopher Jackson at the Signe of the Cocke in Crooked-Lane," he writes, "who by my directions hath made of them for me, and hath the scantling thereof."

It was, however, another design of chain that was destined to survive for over three centuries. Edmund Gunther, Professor of Mathematics at Gresham College, had proposed a chain of 66 feet or four poles or rods in length, divided into 100 links which ultimately became the standard, since 10 square "Gunther chains" equaled an acre.

Rathborne avoided trigonometric computations as did other early surveyors. Every effort was made to reduce mathematical calculations to a minimum. Areas of the various fields graphically plotted in a survey were determined by division into triangles. In 1653, however, another English mathematiciansurveyor, William Leybourn, in *The Compleat Surveyor*, includes a chapter on "Trigonometry, on the Doctrine of the dimension of Plain Triangles, by Sines, Tangents and Logarithms" . . . and here first appears the modern method of determining whether a survey made by traversing and metes and bounds closes. The mathematical calculation of areas by "double meridian distance" did not follow until 1724.

Rathborne devotes his final, or "Fourth Booke," to what he regards as "The Legall Part of Survey," or the laws "what I hold fit and meete for a Surveyor to know and understand." Under the manorial system of land holdings there had been little need for accurate boundary surveys. Anthony Fitzherbert, in a work published in 1523, The Boke of

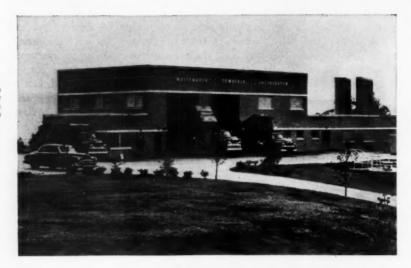
Surveyinge, had noted: "The name of a Surveyour is a frenche name and is as much to say in Englyshe, as an overseer." In surveying a manorial property the overseer was interested primarily in the use of the land. Fitzherbert states he should "knowe howe many acres each parcell contevneth, and how much thereof was meadowe grounde, how much pasture grounde, how much woode grounde, or busshe grounde, heythe, lynge, or such other." However, the open fields, lord's pastures, common lands, and cultivated strips of the manor holdings began to give way to enclosure in the early 16th Century. Fields were fenced first to provide pasture for sheep in the rise of the wool trade. This movement later continued as former serfs and peasants were released and gradually became independent tenants or property holders. Enclosure, which was to continue even into the early 19th Century, was thus under way in Rathborne's day. His "Booke Four" offers a confusing discussion of the many laws and rules applying to manor lands of various types, to various forms of ownership and holdings, to glebe lands, tenants, demesnes, freeholds, and copy-holds.

Land surveys were obviously of increasing importance, and surveying attracted many incompetent workers. Rathborne deplores the "abuse now growne shamefully generall, by the multitude of simple and ignorant persons (using, or rather abusing, that good playne instrument, called the Playne Table) who having but once observed a Surveyor, by looking over his shoulder, how and in what manner he directs his sights, and draws his lines thereon: they presently apprehend the businesse, provide them of some cast Playne Table, and within small time after, you shall heare them tell you wonders, and of what rare feats they can performe." He undertook to correct such abuse by declaring the great and infinite pleasure, with no lesse profit, which the true knowledge, use and understanding of this antique and necessary art of surveying may bring as well to Surveyors, as all owners and occupyers of land."

His title page shows in a vignette the competent surveyor at work with the theodolite, trampling under foot his ignorant competitors, the fools and asses of the art. Rathborne has thus left us an interesting and historically-revealing book. He defends his brevity by remarking in closing, "I will forebeare to pester the practicioner in reading, or my selfe in writing, of needlesse varieties; and therefore will here conclude my labours, and expose them to thy good liking." Several erratum follow, excused by the rhymed couplet:

"Mens workes have faults, since ADAM first offended, And those in these, are thus to be amended." The new incinerator at Whitemarsh. Note the neat compact lines of the building and the low stacks of the wet scrubbers which emit a plume of steam. Glace & Glace, Inc. were consulting engineers for the project.

new method lowers refuse disposal costs—gives communities



smoke-free, odorless, economical incineration

Communities across the country have experimented with various methods of refuse disposal. Their experiences amount to a test-in-actual-use of practically every approach to the problem. Today, backed by cost, convenience and long range land use considerations, many have gone to incineration as the best solution. This is especially true since a new type of incinerator now brings costs into line with most community budgets.

This new type of incinerator was adopted by Dravo Corporation after intensive research into the refuse and sludge disposal problems of communities of all sizes. The Dravo Incinerator provides almost completely automatic operation and reduces the number of operators required. It takes full advantage of the latest materials handling techniques to eliminate litter. It utilizes modern combustion principles to eliminate smoke and odor. Each part of the system has been selected for rugged construction and ability to contribute to overall efficiency. Two of the most important parts are the storage conveyor and the furnace.

THE STORAGE CONVEYOR. Trucks are dumped indoors so that trash will not be scattered around the area. Refuse falls through an opening in the floor directly into the conveyor hoppers. The hoppers oscillate mechanically, throwing the material forward. This action is self-scouring and refuse does not stick to the sides or bottom of the hopper.

The refuse empties into feeders which charge it into the furnace. Automatically operated on a controlled time cycle, the feeders lock a layer of refuse against the furnace gates. This maintains an effective seal, permitting good control of furnace draft.

THEWATER-COOLED FURNACE.

The furnace is constructed of first quality fire brick in which water filled cooling pipes are embedded on 8-inch centers. The cooling pipes maintain furnace wall temperatures below the slagging point of the refuse ash. This construction permits intermittent operation without the need for a long cooling period. In addi-



Partially loaded hopper. Walls and floor are kept clean by the oscillating action. The hoppers are mounted on air springs, which compensate automatically for the load in the conveyor.

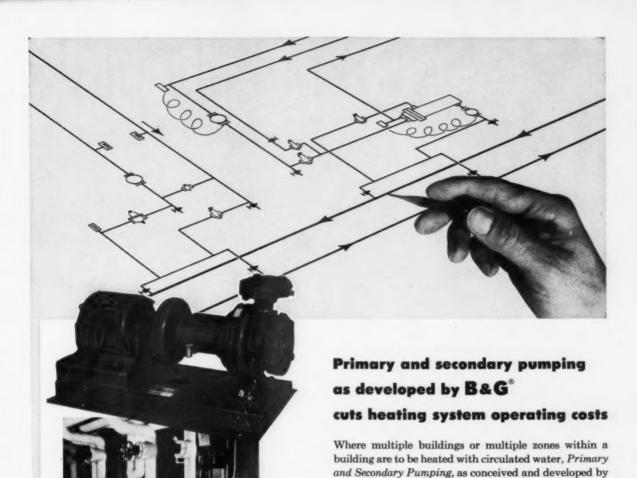
tion, the walls are thinner, and refractory maintenance is reduced to a minimum. The higher combustion temperatures made possible by water cooling improves burning rate and eliminates noxious odors.

The Dravo Incinerator is the economical solution to the problem of refuse disposal. Dravo offers to furnish and erect the mechanical equipment and accepts overall process responsibility. For more information, write or call Dravo Corporation, PITTSBURGH 22, PENNSYLVANIA.



Water-cooled furnace during construction. The cooling pipes can be seen between the courses of refractory brick. Oil burners are used for ignition only; no additional fuel is needed to support combustion of refuse.

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A typical system consists of a primary main continuously circulated by a B&G Universal Pump, with smaller B&G Booster Pumps drawing on the main to supply separate heating zones. Each zone pump is under individual thermostat control, so that each zone can be

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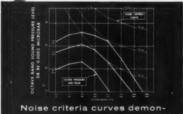


Heat Exchanger



Oil-less Air Compressors

What about the



Noise criteria curves demonstrate permissible sound levels







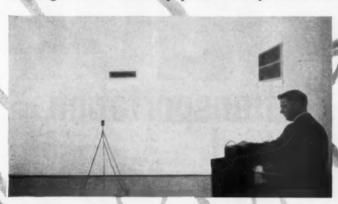
Ask to hear it: new Barber-Colman slide film, "Making Sound Behave."

auditory environment?

Facts about air distribution sound levels of importance to engineers and architects

An architect skillfully uses both color and light to create the proper environment. A good analogy exists between an architect working with frequencies of light (color) and an engineer creating ideal air distribution specifications with sound.

Until recently engineers used only the decibel level in selecting air distribution equipment. Today this is not



enough to assure comfortable environment, for sound must be measured and specified not only in terms of over-all magnitude, but also in magnitude at different frequency levels.

To help you create the proper auditory environment, Barber-Colman has built modern sound laboratories where engineers break down into eight octave bands the sound of air passing through Uni-Flo diffusers. The decibel value of each band then is charted for a complete range of capacities.

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This bridge is one of the 54 required for something over 200 miles of the Atantic Highway laid across narrow Guatemala.

Guatemala's New "Road to Riches"

A KING'S ORDER and an international treaty failed to get a highway built across Guatemala. Now, more than four centuries after the first construction orders were given, Guatemala's "Road to Riches" is nearing completion.

Charles V of S

Charles V of Spain was the first to visualize a road across Central America. He ordered his men to build it, but Guatemala's mountains proved more powerful than the distant king. Much later, Guatemalans contend that the construction of a highway from Guatemala City to the Atlantic coast was promised by the British in an 1859 treaty. By this treaty, Guatemala supposedly ceded Belize (British Honduras) to the United Kingdom. Because the promised highway never was built, Guatemala has declared the treaty null and void and maintains that Belize should revert to Guatemala.

Now, a century later, through the joint efforts of Guatemala, the International Bank for Reconstruction and Development, two United States consulting engineer firms, and several contractors, the first highway across Guatemala is being completed. Starting at the capital city, the new highway runs northeast for 200 miles, all the way to Puerto Barrios, Guatemala's banana port on the Caribbean.

Scope of the Work

The World Bank first came into the picture in 1955, after the Guatemalan government had spent four years and \$18.5 million on the highway. At the time of the Bank loan, completion of the Atlantic Highway required design and construction of 54 bridges and 208 miles of highway, drainage for 81 miles, and realignment of more than nine miles. After being assured that the project would be under the guidance of qualified consulting engineers, the World Bank agreed to make a loan matching the amount already expended by Guatemala.

Since Guatemalan consultants there are only a few — are engaged primarily in the structural design of small office buildings, the Country turned to the U. S. for engineer-





On the Pacific side, the new highway links with El Salvador's road system. This section runs south of the Pan-American Highway. World Bank financed project.



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ing help. The New York City firms of Tippetts-Abbett-McCarthy-Stratton and Gibbs & Hill Inc. were eventually retained.

Design Problems

Unusual design problems began where the highway started just outside Guatamala City. The Las Vacas River, running along the bottom of a 200-ft deep canyon, has long impeded any northern development. Thus, design of a bridge was the first order of business on the highway project. The new bridge was completed and opened to traffic in November 1958.

In the meantime, work on the other sections of the Atlantic Highway was in progress. The most difficult problems were encountered in two mountainous sections, one near Guatemala City itself and the other in the middle section. It had been estimated that \$4 million would be required for stabilization work and structures in the 80 kilometers of mountainous territory west of Guatemala City. However, the consulting engineers were able to save three-quarters of this amount by abandoning a projected tunnel through Jutiapilla, and allowing slides to occur on the mountain until stability was achieved.

The Agua Caliente Bridge on the Atlantic Highway also presented a problem to the designers, since the approaches on both sides of the "Hot Water" River were inclined to each other. The solution was a curved plate-girder bridge which consists of five spans and is 500-ft long. The work at the bridge site was complicated by the existence of several boiling water springs in the bed of the river. It is reported that drilling operations produced several replicas of "Old Faithful."

Other Highway Construction

Tippetts - Abbett - McCarthy - Stratton and Gibbs & Hill Inc. also are advising the Guatemalan government on the design of other highway construction in Guatemala.

Principal project is the new Pacific Highway which runs parallel to the Pan American Highway but south of it, on the Pacific coastal plain. Almost completed, this highway will open up rich lands on the Pacific coast and provide a link not only with Mexico to the northwest, but also with the new Pacific Highway in El Salvador. The principal problem on the various sections of this highway has been the bridging of the many streams flowing swiftly into the ocean from the main central ridge.

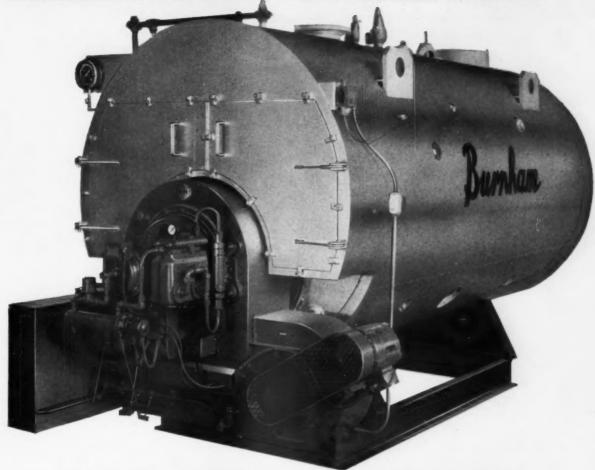
The Pacific Highway connects with the new El Salvador littoral highway (another 200-mile Tippetts - Abbett - McCarthy - Stratton project). The two nations are sharing the cost of a treaty bridge across the Rio Paz. The extension to the Mexican border is completed, but work on the road in Mexico has progressed slowly.

In fulfillment of their contract, the consulting engineers trained Guatemalans on the site and in New York City. The Highway Bridge Division and the Highway Design Division worked under the supervision of the consultants on all layout, design, and supervision of construction. The larger bridges were designed in New York, but the remainder of the design and the writing of comprehensive specifications were handled in Guatemala by North American engineers.

During the project, Guatemala underwent a brief revolution. The revolt was noticed on the highway site primarily on payday, when money was slow in arriving. Some of the workers missed a few days on the job, and the program itself suffered some delay until the new regime was convinced of its merit.

Guatemala's highway, once called the "Road to Riches," is expected to revolutionize the economy of the Central American nation. For the first time, Guatemala's 3.5 million inhabitants will have free access to virgin agricultural land and the unifying advantages of overland shipping.

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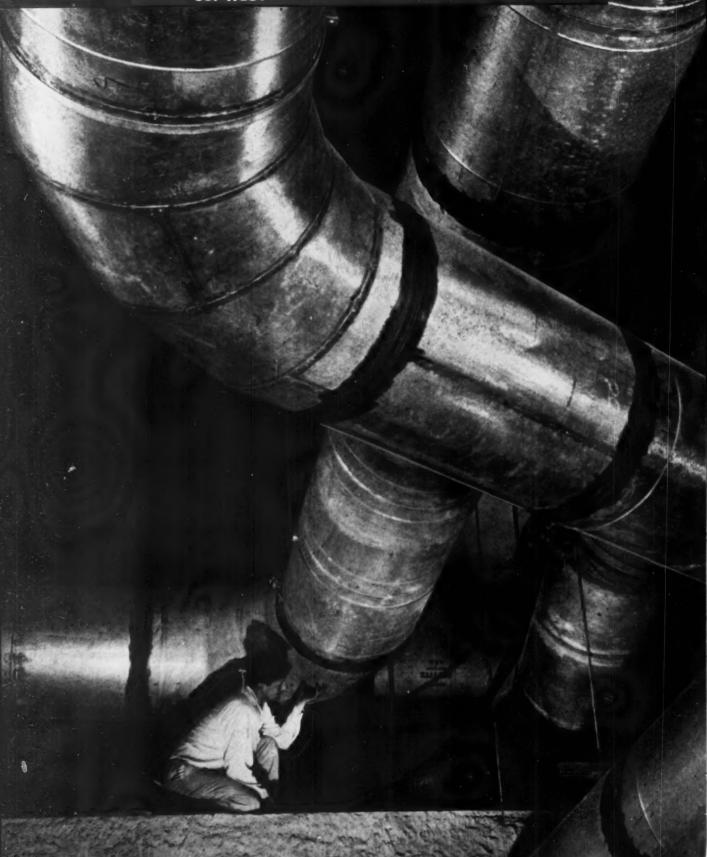
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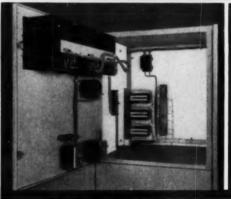
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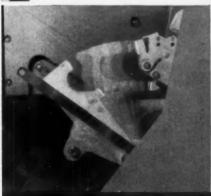
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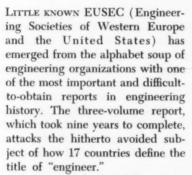
I-T-E CIRCUIT BREAKER COMPANY

FIELD NOTES

EUSEC Report Compares

Engineers of 17 Nations

MARJORIE ODEN, Eastern Editor



As anyone who has followed the proceedings of FIDIC (International Federation of Consulting Engineers) or any other international organization knows, discussion of any subject is difficult because mere translation does not begin to cover the shades of meaning in engineering terms and titles in the various countries. EUSEC recognized this problem at its second meeting back in 1951 at The Hague, and appointed a task committee to "establish procedures to facilitate the interchange of views on the various methods followed, in the countries of the participating societies, for the education and training of engineers."

The task committee began a study of university and practical training of engineers, as well as established criteria for professional recognition. As this work progressed, EUSEC recognized its importance and put major emphasis on this phase of the program.

Others also realized the report's potential. The Organization for European Economic Cooperation gave EUSEC \$23,000 with the request that all OEEC countries be covered. The Ford Foundation added another \$30,000, and EUSEC countries in Europe contributed \$7000.

The United States' contribution was not merely monetary. Dean Thorndike Saville, of the University of Florida's Science and Engineering Study project, was committee chairman. Wm. H. Wisely, ASCE executive secretary, and EUSEC secretary, coordinated the report.

The first and most of the second volume – just completed – concentrate primarily on differences in engineering education in the various countries. The third volume will be a glossary of terms.

Professional Criteria

Most interesting part to consulting engineers and to anyone dealing with consultants on an international basis is the last portion of the second volume – "Criteria for Professional Recognition. A description of procedures now in effect in the various countries, both by custom and by law, to protect the practice of engineering and to accord professional recognition to engineers."

EUSEC countries covered are Austria, Belgium, Denmark, Finland, France, West Germany, Holland, Italy, Norway, Spain, Sweden, Switzerland, United Kingdom, and the United States. Added at OEEC request were Greece, Iceland, Ireland, Luxembourg, and Turkey. EUSEC still hopes to get a report from Portugal, which would be added as an appendix.

As EUSEC explained, "The present report represents the first attempt at collaboration between the Engineering Societies of Western Europe and the United States of America to present a comprehensive, accurate, and objective comparison of the national systems of engineering education and training in these countries. The differences in educational and professional philosophies, as well as language, have made this effort extremely difficult. Nothing like it has been undertaken before."

EUSEC policy throughout is just to give facts, leaving conclusions to the reader. The results are good.

Definition of Engineer

As in most comprehensive engineering reports, EUSEC's begins with a basic definition of an engineer to be used as a basis of comparison. It reads:

"A professional engineer is competent by virtue of his fundamental education and training to apply the scientific method and outlook to the solution of problems, and to assume personal responsibility for the development and application of en-



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gineering science and techniques especially in research, designing, manufacturing, superintending, and managing. His work is predominantly intellectual and varied, and not of a routine mental or physical character, but requires the exercise of original thought and, if necessary, the responsibility for supervising the technical and administrative work of others.

"His education will have been such as to make him capable of closely and continuously following all progress in his branch of engineering science by consulting newly published work on a worldwide basis, assimilating this information, and applying it independently. He must be able to make contributions to the development of engineering science and its application.

"By virtue of his education and training he will have acquired a broad and general appreciation of the engineering sciences as well as a thorough insight into the special features of his own branch, with the result that in due time he can give authoritative technical advice, or be responsible for the direction of important tasks in his branch."

EUSEC found considerable variation in laws and customs relating to the legal status of the professional engineer and the criteria for his professional recognition. "These variations generally are due to the differences in the histories of the development of the engineering profession, and in the systems of engineering education adopted, rather than to any major differences of opinion."

Even more variety was found in the legal recognition of the professional engineer — perhaps none so mixed up as in the United States, which has as many criteria as it has states.

Variations By Countries

What is an engineer and what is engineering? A condensed version of EUSEC's report shows:

Austria - No regulations which restrict the right to practice the pro-

fession of engineering in the field of private enterprise, but for the construction of certain works involving public interests or public safety, approval of the designs and calculations will be given or controlled by the holder of a license—the Ziviltechniker.

Ziviltechniker includes consulting engineers, civil engineers, and architects, and all these are covered by compulsory membership in the Austrian Engineers' Chambers. In order to obtain the license of Ziviltechniker, it is necessary that the applicant: (a) have completed an adequate educational course of university level; (b) have done practical engineering work on a vocational basis for several years; (c) have passed a special examination before a State examining board.

Although the practice of engineering is not otherwise controlled, the titles of *Ingenieur*, *Diplom-Ingenieur* and *Doktor der technischen wissenschaften* are protected by law.

BELGIUM — In order to practice a profession which includes the word Ingenieur it is necessary to be in possession of a Diplome d'Ingenieur issued in accordance with law. Penalties are incurred by persons who violate the legal requirements in this respect. Penalties also are incurred by an employer who publicly uses the title of Ingenieur for an employee not authorized by law to use the title, or who imposes the title upon an employee.

There are four types of engineers recognized under Belgian law at present: Ingenieur civil; Ingenieur agronome; Ingenieur commercial; and Ingenieur technicien.

Although the term Professional Engineer is not used in Belgium, the definition, as given by EUSEC, is accepted in all respects and there is considerable vigilance on the part of the Federation Royale des Associations Belges d'Ingenieurs with respect to engineers in ensuring that the protection accorded by law to holders of the title Ingenieur civil (with the appro-





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priate suffix describing the specialty) shall be effective.

DENMARK — Any person, corporation, or partnership may practice engineering without any specified educational qualification, approval by government agency, or membership in a professional institution. In practice, however, the public is guided by the use of academic titles and membership in professional institutions. Only graduates of the Danmarks Tekniske Hogskoke can legally use the titles Akademiingior and Civil-ingenior, which apply to chemical, civil, electrical, and mechanical engineers.

Only professionally qualified engineers can occupy certain government engineering posts, or be principals or partners in consulting firms, or chief engineers in private industry. This requirement does not apply to employees.

The Society of Consulting Engineers only accepts members who have had several years' experience in consulting engineering and are members of the Institution of Danish Civil Engineers.

FINLAND — It is generally considered that a holder of the title *Diplomi-insinoori* would comply with the definition of a professional engineer as given by EUSEC.

Although there are no legal restrictions on the matter, it is quite clear that in order to achieve professional status it is necessary to obtain at least the degree of *Diplomi-insinoori* so that professional practice can be carried on without restriction.

France – The profession of "engineer" is not clearly defined and the use of the title *Ingenieur* is not controlled. However, the title of *Ingenieur* conferred by a diploma is protected by law relating to "the conditions of award and the use of the title *Ingenieur diplome*."

Some years of application have shown the insufficiency of the law of 1934, which continues to allow anyone who entitles himself "engineer" to practice in the profession and also allows industrial con-

cerns to give the title of engineer to a person carrying out duties which normally are not considered within the province of an engineer. Consequently the Federation des Associations et Societes Françaises d'Ingenieurs has repeatedly given consideration to the question of more precise legal requirements regarding the functions and the profession of the engineer. But, in view of the difficulties in implementing such regulations, it recently decided to retain the status quo and to maintain a strict surveillance of the proper use of Ingenieur diplome.

West Germany — In the Federal Republic of Germany, anyone or any corporation or partnership may legally practice engineering without restriction. The titles *Diplom-Ingenieur* and *Doktor-Ingenieur*, obtained after successful completion of the appropriate course, are academic titles, and as such are legally protected. The title *Ingenieur*, however, is not legally protected, but efforts are being made to have this altered.

Membership in the Verein Deutscher Ingenieure is open to graduates of courses of approved rank, or to self-educated engineers who have had at least eight years of engineering practice.

GREECE — The right to practice as a professional engineer is granted, according to law, only to graduates of an engineering school of recognized university level.

Private organizations engaged in any kind of technical work may employ persons who are not officially recognized as professional engineers, but such persons are not permitted to undertake official engineering tasks such as the responsibility for working out and signing of projects to be submitted for government approval.

IRELAND — Individuals, partnerships, companies, and corporations may practice engineering without any special legal restrictions.

The majority of those who practice engineering in Ireland are uni-

Facts you should have on file under "stokers"... and "savings"

(File this page, send coupon now)

Whether your company will talk new stoker next month or three years from now, your review of stoker performance will not be complete without the facts on AE Vibra-Grate Stokers and the outstanding savings assured with the exclusive Vibra-Grate design.

The AE Vibra-Grate Stoker is the only stoker which combines the maintenance-savings features of water cooling and the high-efficiency features of a vibrating grate and controlled zone undergrate air.

Operating reports from some of the country's most cost-conscious companies now using Vibra-Grate Stokers are nothing short of phenomenal.

For example: A 40,000 lb boiler fired by a Vibra-Grate Stoker at S. C. Johnson & Son (makers of Johnson Wax Products) has never had an unscheduled shutdown since the stoker was installed in October 1954. Coal savings have averaged 919 tons per year. There has been no trouble with clinkers or coking coals. Total repair costs for the first five years, when 34,962 tons of coal were consumed, were only \$188. A hair over ½ cent per ton of coal!

For example: At Spaulding Fibre Company, two Vibra-Grate Stokers have saved 2000 tons of coal in two years, compared with other stokers in the same plant. Average evaporation on one unit is 10.6 lb of steam, 10.8 on the other, using coals having an average Btu value of 13,173. The company writes, "... efficiency and operating economies far in excess of the manufacturer's guarantee and our highest expectations".

For example: Savings of \$300 a day are reported by a major textile manufacturer. In this instance oil fired boilers were replaced by a 70.000 lb/hr Vibra-Grate Stoker. The unit is operating at 80.7% efficiency, even though the boiler has no heat recovery equipment.

For example: An old 40,000 lb/hr boiler was restokered with a Vibra-Grate for Edgewood Division, Pilgrim

State Hospital, Brentwood, Long Island. Savings are averaging 8 tons of coal per day.

Highest efficiencies anywhere

Because the AE Vibra-Grate Stoker design is completely different you get a range and combination of advantages not possible with any other stoker.



The vibrating grate (A) insures compact distribution of fuel, and elimination of holes and light spots. Thus, the stoker can handle low or high volatile bituminous coal, as well as lignite and semi-anthracites—wet or dry.

Water-cooled grate (B) permits use of gas or oil fuels, singly or in combination with coal. Clinkering and coking are minimized, grate maintenance is virtually nil.

Individual control of combustion air in separate wind box zones (C), plus over-fire air system, eliminates smoke at both high and low steaming rates. There is no need for a dust collector. Ashes can be removed by conventional systems.

The complete Vibra-Grate story is covered in our new catalog S-546-A. Send for your free copy now, so all the Vibra-Grate facts will be available when you need them.



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Standard Slide Valve, screwed end type or flanged (shown); when fully open, valve offers no restriction to fluid flow. Bulletin 500R.

"Kwikleen" Slide Valve—Not necessary to remove from line for cleaning. Sediment discharged at bottom. Complete cleanout by attaching steam, water or air line to plug hole in valve body. Bulletin 501R.





Heavy Duty "Kwikleen" Valve for line pressures to 60 psi. Blade not exposed when in fully open position. Ideal for pulp stock, slurries, dust, fly ash, scale, granular materials. Bulletin 508.

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versity graduates and are members of the Institution of Civil Engineers of Ireland, the Engineers' Association, or one of the British Engineering Institutions with headquarters in London.

ITALY — A new law with a definition of a professional engineer is now in preparation. However, the profession and title of *Ingegnere* is clearly defined and strictly controlled. The academic title *Dottore Ingegneria* does not in itself confer the right to practice the profession of engineering.

The title of *Ingegnere* is granted at the successful passing of a State examination, both oral and written, to which are admitted all those *Dottore Ingegneria* who have graduated from Italian universities and a few others (mostly Italian citizens with equivalent degrees obtained abroad). The state examination is, in practice, a repetition of some of the university examination and as such is strongly objected to by some professional groups.

Only the title of Ingegnere qualifies for registration in the Albo Professionale, and only those registered can freely practice the profession. Italy is the only country in the world which does not allow corporations to practice engineering. (The U. S. is spotty on this.) THE NETHERLANDS - Those who obtain the final diploma of the Technische Hogeschool are called Ingenieur, and they use the abbreviation Ir. or ir. before the family name. These Ingenieurs are associated in the Royal Institution of Engineers in the Netherlands.

The Stichting ing. registration foundation enrolls persons who, although lacking an academic education, are considered sufficiently qualified by experience, responsibility, and an examination equivalent to the associate membership examination of the British Chartered Institutions, and gives them a certificate of enrollment. It grants the holder the right to add the abbreviation ing. after the family name. These persons may call

themselves, in the Netherlands, "Register-Ingenieur" and abroad "Netherlands Professional Engineer." But they cannot use the Ir. abbreviation reserved for graduate engineers.

Norway — Any person can legally practice engineering without any specific requirements of education, approval by government agency, or membership in a professional engineering society.

However, the general criterion accepted in Norway for recognition as a professional engineer is the degree Sivilingenior from an engineering school of approved standing. The title Sivilingenior denotes a professional engineer as defined by EUSEC. This title is recognized by law and is protected for the use of graduates.

Spain – The right to use the title *Ingeniero* is restricted by law to those who have obtained this title in an official school of engineering, either in Spain or abroad. And "the public practice – even in private works – of tasks belonging to the engineering professions without possession of the corresponding degree will be punished."

Sweden - Any person, corporation, or partnership may practice engineering without any specified educational requirements, approval by government agency, or membership in a professional engineering association. But only graduates of The Royal Institute of Technology and of the Chalmers University of Technology may use the title Civilingenjor, Bergeingenjor, and Arkitekt. The first title refers to chemical, civil, electrical, and mechanical engineers. The second title is for mining and metallurgical engineers; the third for architects.

The majority of the members of the Swedish Association of Engineers and Architects have the equivalent of a master's degree, and the Code of Ethics of the Association is respected by all practicing engineers.

SWITZERLAND - Registration by Registre Suisse Des Ingenieurs Catalogs you should have for your ready reference if you want Aluminum or Steel Windows or Curtain-Walls - or Detention Window Systems - that

Back Up Your Work With Quality and **Better Service**

Windows and Curtain-Walls are an important and major integral part of a building structure. Therefore, it pays in ultimate overall savings to specify the best quality product the market affords — especially in consideration of initial cost and minimum maintenance. What you actually gain in the long run results from much more than the mere physical product itself. A sub-contractor's years of experience, know-how and proven policy of client-responsibilities all account for much of the true value.

When you specify Bayley, you are assured of an intrinsically good product, a supplier capable of handling large or small jobs plus the many extra benefits that come from -

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- Capabilities that are backed up by Bayley's 80 years of reliable service to the construction industry



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(RIAT) and admission to Societe Suisse des Ingenieurs et des Architectes (SIA) are granted by request to engineers with diplomas from a Swiss Polytechnic School. Persons not qualified or who present diplomas not recognized must satisfy the following conditions: (a) have had a satisfactory general education; (b) possess the necessary knowledge and aptitude for practicing the profession; (c) have had normal practice in the profession with good results from two to fifteen years, depending upon circumstances. (This period is shortened if the candidate demonstrates that he has personally accomplished important works.)

Being a member of SIA and registered by RIAT are recognized publicly as criteria of professional capacity.

UNITED KINCDOM – The Charter and Bylaws of the Institution of Civil Engineers, of the Institution of Mechanical Engineers, and of the Institution of Electrical Engineers all have accepted the EUSEC definition of professional engineer.

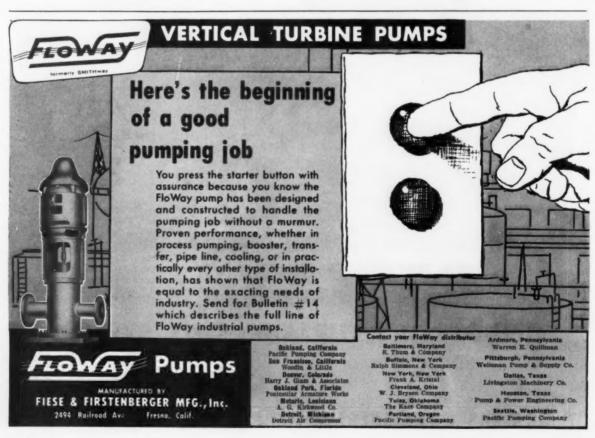
There is no statutory registration of engineers in the United Kingdom, and anyone can call himself an engineer and work as such. However, the terms of chartered civil engineer, chartered mechanical engineer, and chartered electrical engineer are by law reserved to members of the respective Institutions. An overwhelming majority of those who practice as professional engineers in the United Kingdom are corporate members of one or more of the three senior Engineering Institutions.

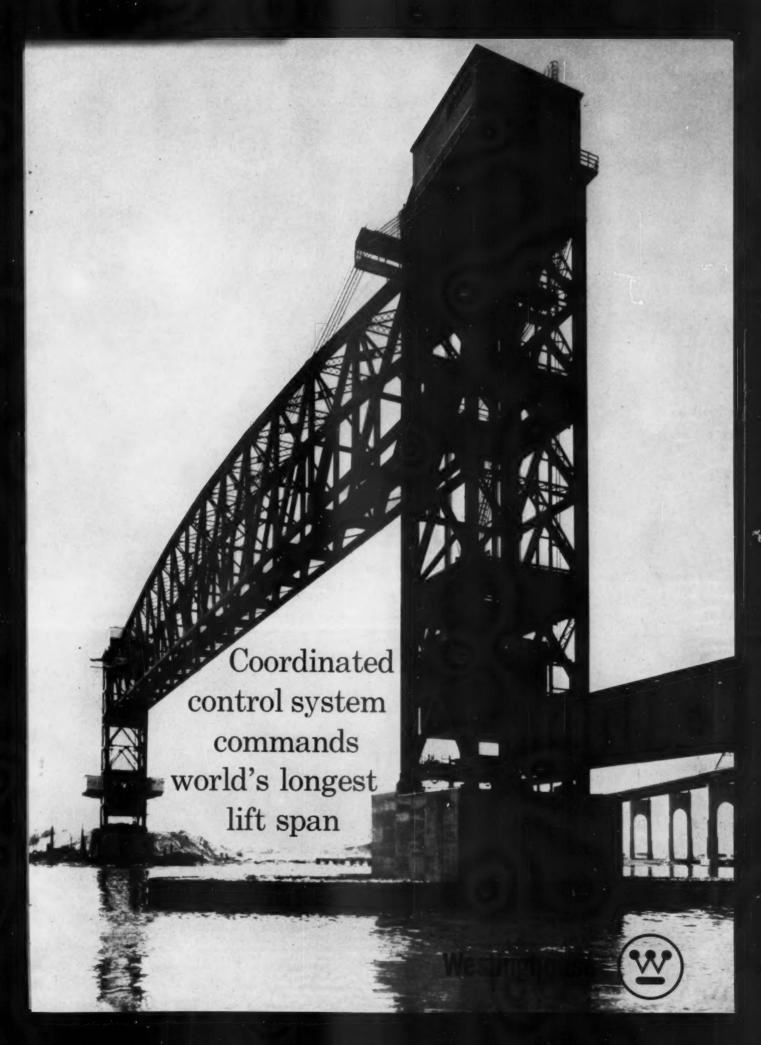
In general, consulting engineers are members of the Association of Consulting Engineers as well as being members of one or more of the chartered groups. Engineers who practice as consultants must, if they are corporate members of the Institution of Civil Engineers or the Institution of Electrical Engineers, comply with the bylaws of these Institutions for consultants.

Institution membership requires a degree from an approved university or the passing of an examination. Each membership grade also has minimum age restrictions.

UNITED STATES - Legal registration of professional engineers is carried out under the powers of the individual states and territories. The general acceptance of the principle of registration became fairly widespread only in the last 30 years. Currently, the National Society of Professional Engineers estimates that about 227,000 out of 400,000 engineers eligible for registration in the country are registered. The general principles enunciated in the EUSEC definition are generally similar to those in the state laws and the society charters.

Membership in the national engineering societies, except NSPE, is not limited to registered or licensed engineers. But only legally registered engineers are entitled to use the designation "professional engineer."





ON COVER: The Arthur Kill Lift Bridge between Staten Island, N. Y., and Elizabeth, N. J., was designed by Parsons, Brinckerhoff, Quade & Douglas for The Staten Island Rapid Transit Railway Company (a wholly owned subsidiary of The Baltimore and Ohio Railroad Company) and built by American Bridge Division of the United States Steel Corporation. 1645 feet long over-all, the bridge is shown with its 558-foot central span in raised position.

Westinghouse electrical system gives precise, reliable control over vertical lift of 2,000-ton span

The new Arthur Kill Bridge boasts the longest vertical lift span ever constructed. The record length span replaces an old swing bridge whose center pier had become a navigational hazard. Westinghouse equipment quickly and smoothly elevates the span 104 feet to leave a 500-foot-wide clear navigation channel for the passage of ships—lowers the span for rail traffic.

Suspended between two shore towers, the counterweighted main span is operated by giant cable sheaves driven through reduction gearing. Measuring 558 feet in length and weighing four million pounds, it can be raised or lowered through its 104-foot travel in approximately two minutes. The d-c adjustable voltage drive, furnished by Westinghouse, gives precision speed control and holds skew of the span to a minimum throughout the normal operation cycle.

Smooth acceleration to maximum speed and gentle controlled retardation to stop give the bridge every assurance of a long and useful life with a minimum of maintenance. Standardized d-c mill motors furnish drive power for span operation. Heart of the

precision speed control is the Westinghouse Magamp exciter regulator. This simplified design uses the completely static Magamp and a single field rotating exciter to provide top performance with extremely low maintenance.

Drives in each tower are synchronized by a sensitive skew detection scheme which uses static elements to automatically reduce voltage to the leading motor and increase voltage to the trailing motor. This system can be expected to keep the two ends of the lift span within close limits of being perfectly level throughout its travel. To assure bridge operation under emergency conditions, a stand-by diesel engine generator set is installed. A duplicate drive system is also provided and is available at the option of the bridge operator at any time. (cont'd)

J-94150-A2

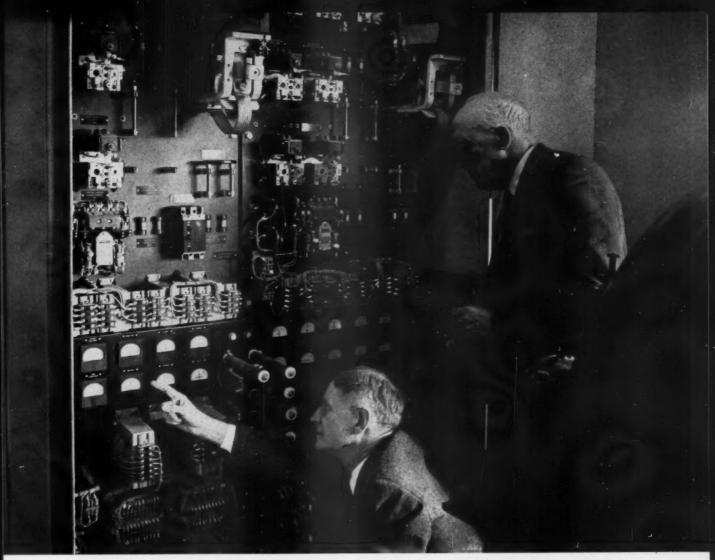




View of main control room in east tower, showing desk from which operator controls all main and auxiliary bridge drives. Special instrumentation, including height and skew indicators, keeps bridge tender informed of all operating conditions. Drive system transfer and power source selection is made from this console. W. C. Carl explains conveniently grouped controls to N. L. Ziegler, Division Engineer (left); J. F. Stevens, Superintendent; and P. K. Partee, General Manager.



Discussing main drive equipment in east tower are M. B. Trimble, Westinghouse Construction Engineer; G. R. Keltie and W. C. Carl. Two type MCPA-614, 135-hp Westinghouse mill motors are shown above—one motor for each of the duplicate drive systems. Systems are arranged so that one motor in each tower can drive span at rated speed. These rugged, heavy-duty, standardized motors assure reliable operation under all conditions. Westinghouse type HI-198 thrustor brakes are used for holding bridge at standstill.



G. R. Keltie, Chief Substation Maintainer, The Staten Island Rapid Transit Railway Company, looks on as W. C. Carl, Westinghouse Construction Engineer, points out details of

main d-c control panel. This panel contains type M, 800-amp d-c "loop" contactors, span speed, current limit and skew control Magamps with associated auxiliaries.



Incoming 4160-volt power is reduced to 480 volts by this 500-kva Westinghouse power center. Low-voltage switchgear at rear distributes power to main drive system and bridge electrical auxiliaries. Type DB drawout air circuit breakers provide feeder circuit protection. Discussing installation: John Pucillo, Staten Island Rapid Transit Railway Electrician; Max Pilger, Garfunkel Electric Supply Company; and M. Davis, Westinghouse Sales Supervisor.



John Pucillo is seen operating wall mounted AB-I breaker which controls machinery and room heaters. In foreground, main 125-kw type SK d-c adjustable voltage generator driven by 150-hp type CSP* motor. Generator excitation furnished by Magamp exciter regulator determines operating speed of main drive motors. Small unit at near end is a constant potential generator for drive motor fields and control auxiliaries. The d-c supply for duplicate drive system is furnished by identical equipment.



A Westinghouse control center in the east tower switchboard room is examined by Messrs. Partee, Carl and Ziegler. It contains combination starters for 440-volt auxiliary drives and includes a-c relay panels at each end. Compact control centers are composed of interchangeable, space-saving, easily installed modular units.

J-94150-A3



Coordinated control system commands world's longest lift span (cont'd)

As supplier of the coordinated electrical systems, Westinghouse assumed complete responsibility for their performance. For more information about how this single-source supply can benefit you, contact your nearby Westinghouse construction sales engineer. Or write Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pennsylvania.

OWNER: The Staten Island Rapid Transit Railway
Company (a wholly owned subsidiary of The Baltimore
and Ohio Railroad Company), Staten Island, N. Y.
CONSULTING ENGINEER: Parsons, Brinckerhoff, Quade

& Douglas, New York, N. Y.

GENERAL CONTRACTOR: American Bridge Division, United States Steel Corp., Pittsburgh, Pa.

ELECTRICAL CONTRACTORS: Fischbach and Moore, New York, N. Y.

Lightning Electric Service Co., Newark, N. J.
WESTINGHOUSE DISTRIBUTOR: Garfunkel Electrical
Supply Co., Jersey City, N. J.

J-94150-A 4



Interesting view from mezzanine floor, showing one of four span control auxiliary assemblies. A single machinery take-off to the multiple speed gearbox provides correct ratios to operate type A cam limit switches, height, skew and control transmitters. This construction permitted unit preassembly at machinery builder's plant—assuring fast, easy installation. Seen above: W. C. Carl and G. R. Keltie.

Freight train moving over the recently completed Arthur Kill Lift Bridge is drawn by a diesel engine of The Staten Island Rapid Transit Railway Company.





The new MULTI-ZONE design cuts "downtime" and compensates for intermittent overload in a wide range of tank and process heating applications. Multiple headers and multiple condensate returns provide for FREE-FLO action — with practically instantaneous distribution of steam to all levels of the plate. Condensate "trapping" is held to a minimum. This gives the new MULTI-ZONE PLATECOIL a reserve capacity to deliver under overload conditions during "start-up." It also produces extremely fast recovery of tank temperature with minimum variation.

IN ALL KINDS OF TANK AND PROCESS HEATING



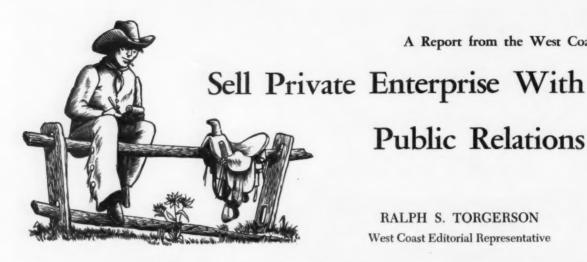
Operating Pressures up to 250 psi — DURAWELD bonding of the plates and mill-controlled TRANSTEEL in standard units have boosted PLATECOIL pressure containment rating up to 250 psi. This makes the time-proven advantages of PLATECOIL applicable to many types of heating where 250 lb. steam is required. Destruction tests have demonstrated a safety factor of 5 to 1.

Low Installation and Maintenance Costs. — PLATECOIL costs are low compared to the cost of engineering, fabricating, installing and maintaining pipe coils. Lightweight, compact PLATECOIL simplify installation. Greater heat transfer per sq. ft. of surface permits smaller units which save valuable tank space. Streamlined surfaces cut cleaning costs. Integral, factory fabricated construction eliminates threaded joints (in the solution) to corrode or leak. All stainless steel and alloy PLATECOIL units affected by cold working are annealed and pickled after fabrication to return the metal to its original condition and thus eliminate the probability of corrosion due to internal stresses and carbide precipitation.

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Public Relations

RALPH S. TORGERSON

West Coast Editorial Representative

Erosion of work opportunities through government action at Federal, state, and local levels is an increasingly difficult problem for the consulting engineering profession. The situation is particularly acute on the West Coast, as both California and Washington have excluded consulting engineers from participation in engineering design contracts with the state highway and public works departments. County and other local government bodies also are trying to take over engineering design work.

Finding a way to fight this invasion of free enterprise is one of the principal tasks facing the state associations of consulting engineers. It is generally agreed that the best approach is to set up effective public relations programs as individuals, as firms, and as associations at both state and national levels.

CEAO Activities

The Consulting Engineers Association of Oregon engaged the services of the public relations department of Pacific National Advertising Agency to direct its program in May 1959. This program will be integrated closely with Consulting Engineers Council's national efforts.

This activity costs money, but a preponderance of the membership believes that the program has greatly enhanced the stature of the profession in Oregon, and ultimately will bring direct benefits to the individual and firm participants. Compared to other members of CEC, the CEAO dues are in a ratio of about 3 to 1. One-half of the State Association's dues are for the public relations program.

One measure of the program's success is the printed publicity obtained during the first year of Oregon's program. Stories about the Association and its members appearing in newspapers and magazines totaled 2735 column inches or an equivalent of 17 pages of standard newspaper size. Much of this space was the result of help offered by association members in the Roseburg, Oregon, disaster and the subsequent organization of the Public Disaster Committee. It is planned to continue to promote the activities of this committee.

The Newspaper Editors Award for the most outstanding job of promoting a public improvement project also will be continued. The purpose of this award is to emphasize the role of the consulting engineer as a conscientious public servant. Another activity will include the preparation of discs and scripts about consultants and their activities for public interest spots on radio stations. Other projects on the agenda include coverage of CEAO projects in publications of other organizations, such as the Chamber of Commerce and the League of Oregon Cities. Assistance will be available to the Educational Committee for stimulation of interest in consulting engineering at the college level, and also to the Legislative Committee for the presentation of information to legislators in the coming session. Special publicity will be given to the CEC Manual of Practice when it is distributed to schools, colleges, and libraries.

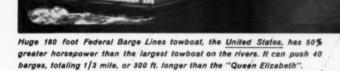
California Is Interested

The Consulting Engineers Association of California also is studying a public relations program, but has decided to wait until revenue from a new dues structure warrants commitments for this purpose. It is believed that a poorly organized and inadequately financed program would be ineffective. However, a speakers' bureau has been set up to present the story of the consulting engineer to college and high school students.

There has been some public relations activity among other engineering groups in California that is noteworthy. The Structural Engineers Association of California has had an active Public Relations Committee which has sponsored a speakers' bureau of members to inform the public on the important part the structural engineer plays in the economic use of all structural

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the world's "HOTTEST" towboat...



Space saving design versatility? Easy installation? Operating dependability? Comparative cost? All these factors were considered by St. Louis Shipbuilding and Steel Company in the selection of air conditioning equipment for the world's most powerful towboat. The shipbuilders' and their design engineers' careful choice? A Curtis 20-ton packaged liquid chiller system. This equipment will cool the crew's quarters, galley, mess room, officers' and guest quarters—all with individual room or area temperature control.

The Curtis complete line, and reputation for dependability in installations of all types, work to the benefit of engineers and mechanical contractors. Factory run-in of all units cuts call backs far below average. You can safely promise dependable performance always up to, and frequently surpassing, rated capacity. You eliminate your problems when you specify Curtis, because you're working with an outstanding manufacturer of air conditioning equipment.

THE COMPLETE LINE OF LIQUID CHILLERS



PACKAGED AIR CONDITIONERS

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All the facts that you need to assure top and dependable master TV system performance. Contains information that is the result of more than 2,000,000 master TV installations featuring Blonder-Tongue Masterline equipment:

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TYPES OF SYSTEMS

New construction; old construction; vertically designed systems; horizontally designed systems.

COMPONENTS IN MASTER TV SYSTEMS

Amplifiers; splitters; tapoffs; antennas; transmission line.

THE 'HEART' OF MASTER TV SYSTEMS

"Head-end"; amplifiers; line filters; feed-thru couplers; radiation-proof housings.

'ARTERIES' OF MASTER TV SYSTEMS

"Branching"; splitters; cable; tapoffs; isolation.

ANTENNA INSTALLATION

Orientation, "directivity"; signal strength; towers and masts.

LINE INSTALLATION

Balanced transmission; co-ax cable: RG/11U and RG/59U; 300 ohm ribbo line; baluns, matching transformers.

Typical system diagrams; vertical cable run systems; hotel, apartment—to 400 outlets, new construction, existing construction; horizontal cable run systems: School or hospital—100 outlets, new construction, hospital—400 outlets, old construction; trailer park system—148 outlets, new or old construction.

TESTING AND MAINTAINING A SYSTEM

Equipment for servicing a system; substitution method; field repairs; testing and maintaining cable.

CHARTS AND TABLES

Amplifier specifications; tapoff— isolation networks; cable characteristics; attenuator pad construction; half wave open ended atub traps, and more

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Company background; products; services: Free engineering service.

GLOSSARY OF MASTER TV TERMS Motel Master TV system

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materials. Particular emphasis has been placed on talks before students interested in engineering.

Another unique engineering organization, the Los Angeles Technical Societies, representing all of the Founder Societies and many other technical groups, is operating quite an extensive public relations program in the area. It now has a 15-minute weekly radio program on KRKD which may be expanded to 30 minutes. It is designed to be of interest to the average lav listener as well as the individual engineering-science society member. The show format includes flash headlines of scientific or technical news; a professional society of the week feature, discussing the purposes, goals, and membership of the society; presentation of a Personality of the Week trophy honoring individual achievements; a women's feature; and also last minute announcements of changes in meeting schedules and locations. Legislative problems are not the concern of this society as it functions almost entirely to promote public interest in engineering and better understanding between all branches of engineering. Consulting engineers have taken a prominent part in the Los Angeles Technical Societies' program.

Engineers Week Exhibit

It has been suggested that Engineers Week might become a more potent public relations tool for the entire engineering profession if an exhibit could be shown in every large city, showing the vital importance of public projects which have been planned and designed by engineers. These annual exhibits might be made self-supporting through the sale of exhibit space. If the exhibit idea is not feasible, moving pictures might be an adequate substitute. Engineers Week currently does not have much impact on the general public. It has been reduced to a mutual admiration affair with engineers addressing engineers at banquets attended by only a few representatives of business, industry, and government.

Firm and Individual Activity

To be effective, public relations must start with the individual or firm. It should not be confused with advertising nor should it be reduced to the mailing out of "plugs" designed to gain attention or free advertising for the consulting firm. Newspaper and magazine editors resent this kind of material for they have difficulty in finding space for even the outstanding news. Thus, the first task in setting up a public relations program is that of deciding what is important enough to merit coverage by the press - and then tailoring it to meet the specific interest of a magazine or newspaper's audience. For large firms this may require a full time employee or the retention of a public relations firm.

Many things can be done by the engineer as an individual to promote good public relations. Time should be devoted, of course, to social contacts with civic-minded groups to erase the "ivory tower" image so commonly ascribed to the engineer. More interest should be taken in politics and politicians. As one veteran engineer put it, "It is generally too late to protest an objectionable bill when it is up for final consideration. Engineers should be acquainted with legislators and proposed legislation long before it is necessary to fight a specific bill. Legislators are human - they respond to those who seek them out.'

Individual engineers also can work closely with the schools. One structural engineer in Los Angeles has taken engineering students on tours of his important projects. Others serve on speakers' bureaus.

All these activities take time a commodity the busy consulting engineer seldom has at his disposal. But every engineer has the obligation to create a climate of public opinion favorable to the advance of the profession.

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These improved Bulletin 700 Type B and Type BX relays are establishing new standards for relay life and reliability. New design increases mechanical life by at least 5 times... a new contact motion insures at least 10 times greater electrical reliability. Double break, silver contacts never need maintenance, and the new molded coil is impervious to the most severe atmospheric conditions.

These new A-B relays—with their extra millions of trouble free operations at no increase in price—are a bargain in the relay field. Write for complete details, today.

TYPE B general purpose relay shown with 2 N.O. and 2 N.C. contacts. Made with up to 8 poles in various arrangements.

TYPE BX universal relay shown with 4 poles having both N.O. and N.C. contacts. Additional contacts on the 6 and 8 pole relays are N.O. only.

NEW ENCLOSURES

for the Bulletin 700 relays are styled by Brooks Stevens—internationally famous industrial designer. Note the "family" resemblance of these enclosures.

NEMA Type 1 for general purpose applications with wrap-around cover for ready accessibility. It has a "quality" appearance.

NEMA Type 4 enclosure for applications that require a watertight and weatherproof seal.

NEMA Type 7 enclosure for NEC Class 1, Group D hazardous gas locations.



NEMA 1



NEMA 4



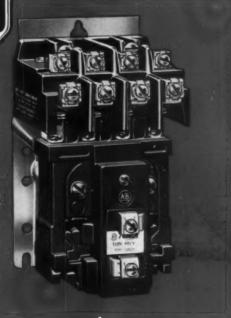
NEMA 7

TYPE BR Bulletin 700 convertible contact relay shown with four poles. Made with up to six poles in line.

No other relay offers such simplicity in changing contacts from N.O. to N.C.

or vice versa)—it takes only 60 seconds!

A four pole unit provides any of the contact combinations otherwise available only with five relays of the fixed contact type. You can reduce your relay inventories. In tests, this relay has proved it will provide many millions of trouble free operations. Double break, silver contacts never need servicing. Also, each relay can have one or two complete and full rated contacts added to its base—in the field—without increasing space requirements. If you don't know about the Type BR relay, let's get acquainted.



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Quality Control Centers

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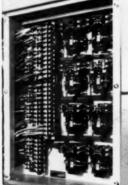
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This shows A-B control center unit with popular A-B Bulletin 709 solenoid starter and circuit breaker.

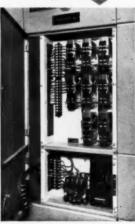


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This shows A-B Bulletin 700 control relays mounted in an A-B control center unit.

A-B control centers can be equipped with a wide variety of components. These Bulletin 849 timers are used on an automatic conveyor line.



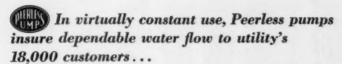
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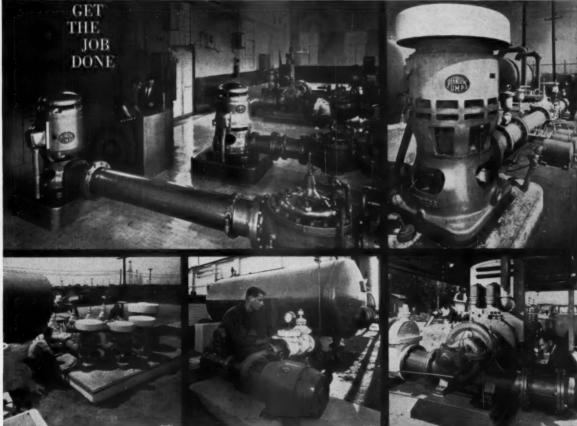


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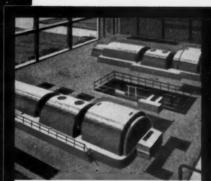
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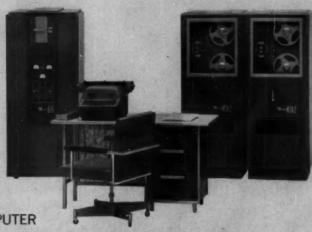


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L = 02 3

FOR E = 100(50)300 BEGIN ®

FOR C = 000002(00000001)0000021 BEGIN (9)

I = E/SQRT(R † 2 + (6.2832 * F * L - (1/(6.2832 * F * C))) † 2) ®

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PRINT (FL) = C (S)

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A Professor Talks Back

EDWARD H. HARRIS

THE West Coast Report (Consulting Engineer, June 1960, p. 162), titled "Unfair Competition from your Alma Mater," will raise the hackles of every university professor who does a bit of consulting work. If this rebuttal seems to pick the original piece apart, it is because I find the original work objectionable in almost every paragraph. No doubt Mr. Torgerson is sincere, but he is sometimes misinformed and often misdirected.

At the outset, it was indicated that consulting engineers quite naturally feel kindly toward their alma maters. However, I do not feel that this is universally true. Being a bit more realistic about the matter, I suggest that men feel about their schools the same way that they feel about all other things—that is, with individually varying attitudes ranging from kindliness to displeasure. My alma mater is not blessed with divinity—neither is that of the consulting engineer.

I can see nothing wrong with using the name of one's university in connection with research work, and certainly a claim that the services of university people are unbiased does not imply that the services of others are fraught with bias. I find my life quite satisfying, and I would be happy to announce it to the public. But if you want to try to get from this statement an implication that your's is not, you will have to use a form of logic with which I have not become acquainted.

I am alarmed that the engineering profession is criticized for taking a timid approach to "the problem" of faculty members taking on consulting assignments. I should think that the engineering profession would do well to take *no* approach before the existence of "the problem" is generally verified — and even then to go easy in setting up controls. It remains my conviction that in this country, if in few others, we resist the setting of standards by one group for the control of another group — except in cases of risk to life, liberty, and the pursuit of happiness.

What is so ungodly about the person called a professor-consultant, and who is the unnamed prominent consultant in the Pacific Northwest who decries "unfair competition from members of engineering faculties . . . "? It seems to me that the professors of engineering are in a good position to assist in advancing the profession in many ways over and above the teaching of young engineers. One of these ways is through consulting on jobs of importance. In the main, it is this type of work which the professors undertake. I do not know whether moonlighting is involved in my practice, since I do not know exactly what moonlighting means. However, twice in the last month reputable consultants have asked me to assist them on particularly messy problems. The consultations were of short duration, but our discussions served to eliminate certain misunderstandings in the basic concepts of structures, and I submit that my friends would have been in much less secure positions without my advice – happily given gratis!

Now, your "West Coast Report" states that one Pacific Northwest engineer has the opinion that "the basic philosophy of most institutions of higher learning [is] to the effect that they are established by the people and are a service agency for the people." This I can agree with, and I suggest that all professional people would be better off if this were their operational philosophy.

It is deplored by Mr. Blume that "profit is greatly overemphasized since the actual profit that private consultants have available is, in my opinion, often much less than the savings in cost to their client that come about through their use." This I earnestly pray is the case, because if it is not, the use of the consultant in the first place was an economic abortion. Are consultants not employed to save or make money for their clients? If this is not the reason for their use, what earthly claim for existence can they have? Blume further states that "it is not true that a group has to be identified with a university in order to provide unbiased, disinterested service to the client." The first part of this two-headed proposition is accepted without argument, but I do not see why it was brought up in the first place. As to the second part, I hope that consultants, professors, and the despised consultant-professors provide, in most cases, interested service to the client.

Mr. Powell is reported to feel that the approach to design problems by professors is very academic — to which I have to reply, a bit tritely, why not? Isn't the academic approach in favor these days? If not, possibly the consultants and the professors should trade places, for we professors consult continually with the best young minds in the country. They will, in a few years, be running the country.

I do not feel that Mr. Powell's comment on fee cutting is appropriate. It would seem better for the consultants to mend their own fences before calling their close neighbors, the professors, to task



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THE EDWIN F. GUTH CO.

IGHTING Inco 1902 * () U. S. Pat. No. 2,745,001 Can. Pat. 1957, No. 538,245 ** () U. S. Pat. No. 2,904,673 in the matter of fees. I have several associates who do consulting work and who intentionally charge somewhat more for their services than do the chaps "downtown" specifically to insure that what the client wants is their services in preference to those available elsewhere. This causes them to lose some work opportunities, but they are quite convinced that the plan allows them to practice without taking advantage of a salaried job in competition with those who must live through their consulting engineering work.

Mr. Wolfe, of Sverdrup and Parcel Engineering Company, believes that it is unfair to practicing engineers for a professor, who has no overhead, to accept engineering work to be performed by his students. And further, he has "heard of at least one instance where a client was sadly disappointed in the final results." I should think that the use of student labor - properly paid for in any capacity other than drafting, computing, or similar tasks, would be quite out of line. Certainly no ethical professor would use them in other capacities. To use university facilities without payment to the university is unfair. However, the fact that some engineering firms do important work using a minimum of principal engineer time and much time of engineers and draftsmen picked up for the job is also to be decried. Even worse, we all know of the thriving farm system of engineering which exists in the large cities. As to the comment about one client who was dissatisfied with the professor's work, I can only comment that this is a rather remarkable record!

The insert titled "Paying Professors to Hide the Truth" seems to me to be pretty far-fetched, and I genuinely wonder if it has happened. If this sort of thing exists, it could place the professor in an untenable position. It must also be remembered that much defense research simply cannot be made public property.

As a penultimate line of comment, Mr. Ham is quoted as believing that "no consulting engineering firm will continue in operation with a history of repeatedly recommending and building unfeasible projects." With this I heartily concur, but nevertheless, the temptation does exist. I wonder if every engineering firm would have the fortitude to submit a steady stream of reports resulting in no design and supervisory work. Some would - but would all?

Mr. Moore wants to keep a critical watch on moonlighting professors. This sounds like a new version of Big-Brother-Is-Watching-You, and I do not like the sound of it. Further, Mr. Moore wants a "clear statement defining the proper, acceptable, and ethical basis of operations for professorconsultants . . ." Such a unilateral code preparation can never produce the mutually acceptable ground rules he wants.

Finally, I feel that the West Coast has been heard from quite loudly enough on this matter, and if the reporting is accurate, there exists in our Western States a need for considerable work in ethics and democracy. What is there inherent in being a professor which should prevent the rendering of a service needed by a client? What is there about being a consultant which reserves for him the right to all of the nation's engineering work not done by engineering employees? It has been my observation that the professors do not, in general, abuse the privilege of doing professional work which most universities accord them. In fact, those with a reasonable amount of practice are enhancing their own abilities and making contributions to their universities and to society. I would be reluctant to have my own sons study with those who can't do what they teach - and, at least in some cases, do it better than those they have taught.

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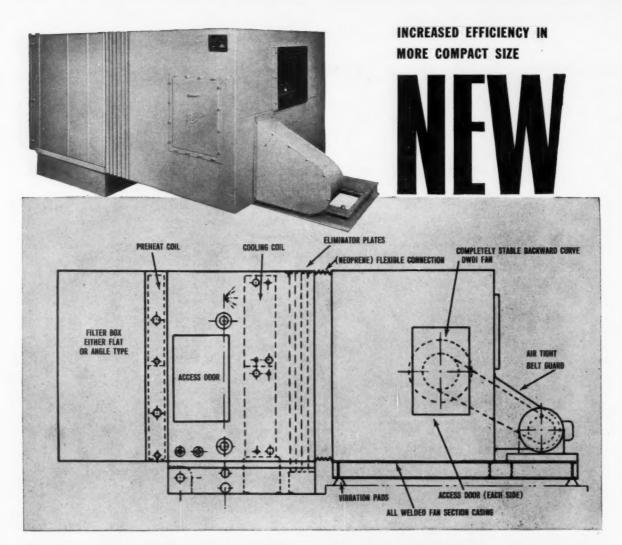
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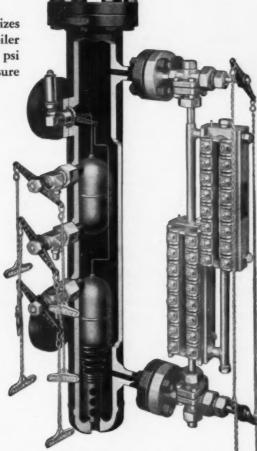


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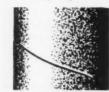
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The Indomitable Tin Goose, by Charles T. Pearson; Abelard-Schuman, Inc., New York, N. Y.; \$4.95.

Preston Tucker died of lung cancer in 1956. Had he confined his activity to the successful Ypsilanti Machine and Tool Company he would have been just another businessman who died too young. But Tucker wanted to build an automobile - The Indomitable Tin Goose.

Today there are some 50 Tucker automobiles (Tin Geese) scattered around the country, each one representing some \$400,000 in corporate assets of the ill fated Tucker Corporation. For in spite of all his troubles, Tucker was able to get almost \$20 million behind his dream of a new car for the American public. And he might have been able to produce it - if!

Pearson, as a friend and employee of Tucker, is probably too close to the story to tell it with detachment. However, he does see his boss as someone less than perfect, and once Tucker the promoter had gotten the funds of willing investors, Pearson has every right to ask why Tucker the production man was not allowed to try to build an automobile unharassed by the SEC. For if there was a villian in the piece beside Tucker himself, it must have been the SEC. Of course, there was also a host of personal enemies including Drew Pearson, Fulton Lewis, Ir., and Senator Ferguson of Michigan. How much their opinions worked against Tucker is anyone's guess. The fact remains that the investors put up \$20 million because they believed in Preston Tucker's ability to produce a new and different car.

But Pearson's main theme is not the personal faults of the individuals involved in the Tucker scheme, or even the political skulduggery that must have existed to some degree. Rather, he wonders about the death of "good old American freewheeling free enterprise." For him, it died with Tucker - and he may be right!

The Story of Engineering, by James Kip Finch; Doubleday & Co., Inc., Garden City, N.Y.; \$1.45.

James Kip Finch is well known to engineers in general, and to readers of Consulting Engineer in particular. His series of articles on the great books of engineering have been extremely popular. His new book should prove equally so.

The Story of Engineering begins with the chief works of Ancient Egypt and ends up with the jumping off point of the early 20th century. In between are over 500 pages of fascinating reading. It is unfortunate that the practice of engineering moved forward so fitfully, for it makes the writing of such a book as this quite difficult. However, by forming a series of logical groupings of subject matter, Professor Finch has managed to keep his story moving fairly smoothly. It is hoped that interest in this new book will be great enough to merit a better job of production Fairbanks-Morse Announces!

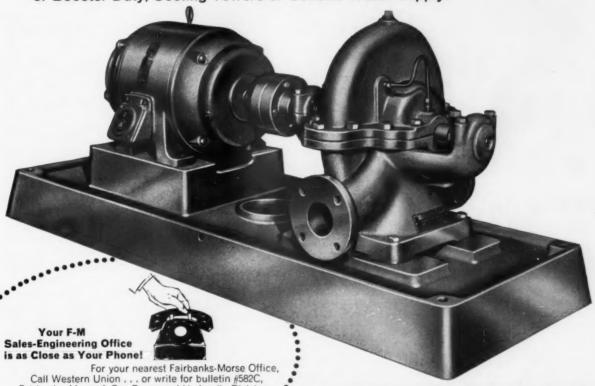
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than the paperback edition in which it is now appearing. However, the mechanical deficiencies of this book's production should not detract from its great interest to engineers and those interested in the profession of engineering.

To those who know James Kip Finch, and his one previous work, Engineering and Western Civilization, there is no need to point out the thoroughness of his research. The problem of selecting material

to be included in a work of such wide scope as *The Story of Engineering* must have been tremendous. Yet, only the professional student of the history of engineering will find much of significance that has been left out. As Professor Whitehead observed, "The history of mankind is yet to be set in its proper relation to the gathering momentum of technological change." While Professor Finch has obviously not made this his ob-

jective, he has come a long way toward it. As he asks, in conclusion, "What profession offers a greater challenge to the man who finds his major rewards in the creation of material things, and thinking through from inception to realization the successful steps which give his brain child those qualities essential to a useful life of service to his fellow men?"

Public Relations and Management, by David Finn; Reinhold Publishing Corp., New York, N.Y.; \$4.50.

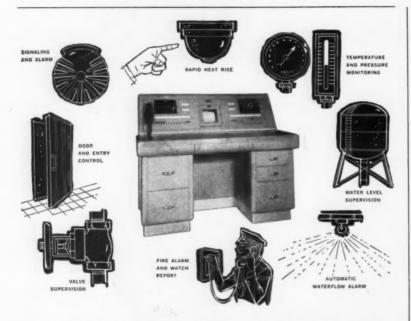
As president of one of the country's leading public relations firms, Mr. Finn speaks with considerable authority on the subject. What is more to the point for the busy consulting engineer, he speaks concisely, for his little book is only 175 pages long.

Because of its ethical implications, the consulting engineer has generally been only reluctantly interested in public relations — even though he may realize its importance. Mr. Finn's own concern with the subjet of ethics, and his obvious sincerity, should give consulting engineers a new attitude toward what they have long felt was a very controversial field of activity for the professions.

Finn is not an exponent of the "do it yourself" school of public relations. However, he does state very clearly and directly how and what public relations can and should do. His book is an excellent guide for anyone newly concerned with the problem of establishing a program of both internal and external public relations.

The Geometry of Golf, by William A. Tripp; Vantage Press, Inc., New York, N.Y.; \$2.50.

When Wm. A. Tripp talks about electrical engineering, consulting engineers are inclined to listen. For Mr. Tripp, as readers of Consulting Engineer well know, is the chief electrical engineer of the J. G.



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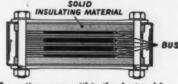
Square D totally enclosed feed-in duct solves the space problem. Solid sheets of insulation permit mounting bus bars only ¼" apart. This solid insulating material is also an effective heat conductor, thus eliminating the need for air spaces. The result—Square D low-impedance duct is as much as 50% smaller than ordinary duct. It can be used where no other duct fits. It makes expansion of existing electrical systems easier, new construction planning simpler. Best of all, Square D low-impedance bus duct is totally enclosed. Having no ventilation holes, it's safe from physical damage and dust accumulation. Needing no ventilation, it can be mounted in any position without de-rating.

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White Engineering Corporation. In his new role, as the author of a textbook on golf, we can only express our admiration for Mr. Tripp's courage and hope that he will be the talk of the 19th hole at golf courses everywhere.

The Geometry of Golf is a clear and logical approach to the game. It is designed primarily for the week-end golfer and guarantees him nothing but an opportunity to climb out of the duffer class.

The great virtue of Mr. Tripp's approach is his positivism. He applies the principles of geometry and mechanics to show the struggling golfer what he should do, rather than what he should not do. The reader is spared the painful agony of reviewing his past and present mistakes.

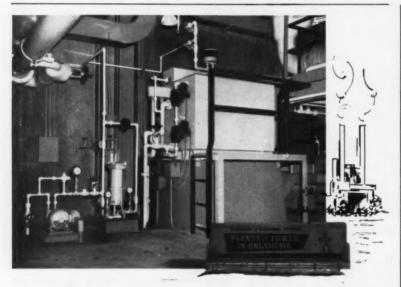
It is only fair to state that Mr. Tripp does not spend much time on the psychology of golf. This, as every Sunday golfer knows, is the toughest part of the game. However, an engineering approach to golf is long overdue. Mr. Tripp's book is to be commended and recommended to all conventioning consulting engineers.

New Technical Books

1960 PLANT LOCATION; Simmons-Boardman Publishing Corp., New York, N. Y.; \$15. This hardbound edition of a paper bound volume published in late March is an excellent source book for industrial site seekers. In addition to a discussion of the current labor market, it carries state by state data including maps, personal income, labor and manufacturing, industrial development, transportation, power and fuel, taxes and labor laws, finance, raw materials, and climate.

1960 AIA BUILDING PRODUCTS REGISTER; American Institute of Architects, Washington, D. C.; \$25. Information for the proper preselection of building materials is presented in a form that is convenient for the user and at the same time provides him with a method of direct comparison of products engineered to perform similar functions. Reference material for each product type is brought together' and summarized in one convenient place through abstracts of standard documents. The first edition of this volume may have some gaps, but it gives every indication of becoming an outstanding contribution to the better selection of building products. However, the one thing which could insure its future usefulness would be joint sponsorship by engineers and architects.

MECHANICS OF MATERIALS, by Archie Higdon, Edward H. Ohlsen, and William B. Stiles; John Wiley & Sons, Inc., New York, N. Y.; \$7.75. Although better illustrated than many of the older texts in this field, this new volume is essentially traditional in its organization. Major



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The Nugent Oiling and Filtering System shown above serves a 150,000 KW Westinghouse Steam Turbine. The installation is located at the Riverbank Generating Station of Oklahoma Gas and Electric Company, Oklahoma City.

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Fig. 687-3 sight overflow.

Fig. 1020TB-3 motor driven oil circulating pump. (10 GPM, ³/₄ HP) Fig. 1555-4S oil polishing filter. (pressure)

Fig. 1142 two-compartment oil storage tank. (Not shown.) Capacity dirty oil compartment—5000 gals. Capacity clean oil compartment—750 gals.

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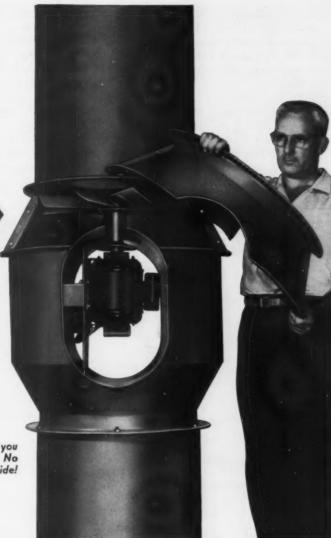
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emphasis is placed on the elastic range of stress, and where feasible, the presentation is extended to include the analysis of the plastic range of stress with appropriate problems.

GLASS: ITS INDUSTRIAL APPLICA-TIONS, by Charles J. Phillips; Reinhold Publishing Corp., New York, N. Y.; \$6.95. This book covers the manufacture, physical and chemical properties, and particularly, the applications of all types of glass. It is directed to the users — engineers, scientists, production and purchasing personnel — who are involved in the design, specification, testing, fabrication, purchase, or sale of glass products. The book reflects all the recent advances in the field and includes new information on such subjects as glass bead reflectorization and the "float glass" process for making flat glass. It avoids extreme detail and con-

denses a mass of information to tabular or graphic form.

NUCLEAR REACTOR OPTIMIZATION, by P. H. Margen; Simmons-Boardman Publishing Corp., New York, N. Y.; \$2.75. One of the Simmons-Boardman series on nuclear engineering, this monograph describes the systematic methods which must be adopted to achieve optimum results from a nuclear reactor and illustrates their application by a complete working example covering the design and optimization of a nuclear station. The discussion is subdivided into the optimization of the physics, the heat transfer properties, and the thermodynamics of the system - all three of which enter into the over-all optimization.

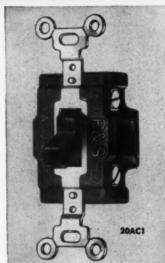
NUCLEAR RADIATION MEASUREMENT, by J. Sharpe; Simmons-Boardman Publishing Corp., New York, N. Y.; \$2.75. In this monograph the ways in which nuclear radiations interact with matter to provide energy for the detection process, and the means by which this energy is utilized are dealt with at some length. The basic physics of detector elements also is set out in detail and this, in turn, is followed by a description of the technical aspects, as related to measurement of specific particles. A short chapter is devoted to the various types of "black box" used with detectors and to such related subjects as counting statistics.

Magnesium and Its Alloys, by C. Sheldon Roberts; John Wiley & Sons, Inc., New York, N. Y.; \$9.00. This book is one of the Wiley series on the science and technology of materials. While avoiding either a shop-manual or a critical-table approach, this book gives a balanced picture of the scientific principles and technological "knowhow" involved in the fabrication and use of magnesium. The extraction, refining, and casting of the metal as well as its chemical and physical properties are considered





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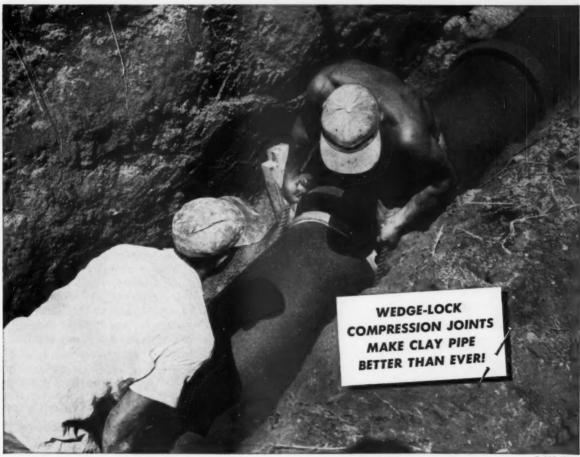
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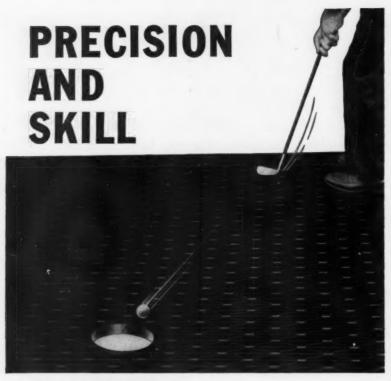
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5056 27th St., LONG ISLAND CITY 1, N. Y. 1856 10th St., OAKLAND 20, CALIFORNIA in detail. This book will prove as useful to those who seek isolated facts as it will to those who desire a general picture of the metal and its characteristics.

SELECTED SEMICONDUCTOR CIRCUITS HANDBOOK, edited by Seymour Schwartz; John Wiley & Sons, Inc., New York, N. Y.; \$12. Over 150 usable, well designed, reliable semiconductor circuits are provided in this handbook. The subject matter covered includes direct-coupled amplifiers, low-frequency amplifiers, high-frequency amplifiers, oscillators, switching circuits, logic circuits, ac to dc power converters; small signal nonlinear circuits, and transistorized magnetic circuits. Design philosophy sections head each group of selected circuits.

CORROSION AND OXIDATION OF METALS, by Ulick R. Evans; St. Martins Press, Inc., New York, N. Y.; \$25. Containing almost 1100 pages, this volume includes the results of the author's life-long research. However, it is actually encyclopedic in scope, with discussions of and hundreds of literature references to the published work of other investigators. At least onethird of the book is devoted to such matters as the protection of steel structures, corrosion inhibitors, and treatment of boiler feedwater. In addition, there is much information on laboratory and measurement techniques of value to those doing basic research on corrosion.

ELECTRONIC ENGINEER'S REFERENCE BOOK, general editor L. E. C. Hughes; The Macmillan Co., New York, N. Y.; \$18. The first edition of this reference, published in London in 1958, was sold out in nine months. Thus, this second edition is very much up-to-date, since the opportunity for revisions and additions came so quickly. Since the book is a product of Great Britain it contains some slight language barriers for U. S. readers because of differences in terminology, and,

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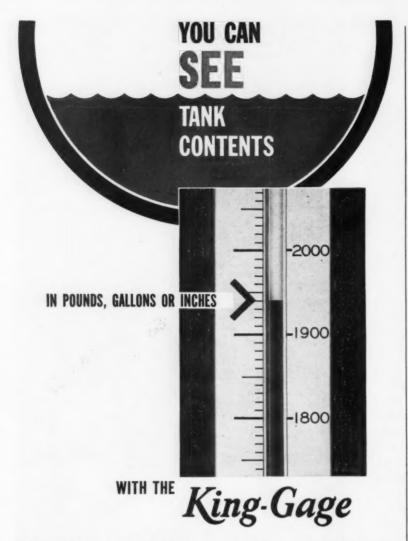
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ESTIMATOR'S ELECTRICAL MAN-HOUR MANUAL, by John S. Page and Iim G. Nation: Gulf Publishing Company, Houston, Texas; \$10.00. This book is a companion volume to Estimator's Piping Man-Hour Manual published last year. It provides an accurate method of estimating direct labor for complete electrical installation for any given system or plant. It explains how a composite rate can be arrived at using productivity efficiency and production elements. With the composite rate, man-hour estimating can be applied with equal validity to any electrical job.

AN INTRODUCTION TO THE ME-CHANICS OF SOLIDS, edited by Stephen H. Crandall and Norman C. Dahl; McGraw-Hill, New York, N. Y.; \$8.50. Dealing with the mechanics of rigid and deformable solids in equilibrium, this text was pretested on MIT classes before being published in permanent form. All discussion and theoretical development has been related to three fundamental physical considerations - study of forces, study of deformation, and connecting forces to deformation by appropriate force-deformation relations. The book is an excellent home-study manual for aspiring engineers, complete with the answers to a good selection of problems for evaluating one's grasp of basic principles.

Soils and Soils Engineering, by R. H. Karol; Prentice-Hall, Inc., Englewood Cliffs, N. J.; \$11.65. This book is one of the Prentice-Hall series in civil engineering. Written by a noted authority on soil stabilization and foundation design, this book includes basic original material on soil stabilization by chemical grouting and covers field sampling methods, techniques, and matters of equipment. It also works out actual problems in detail to illustrate current



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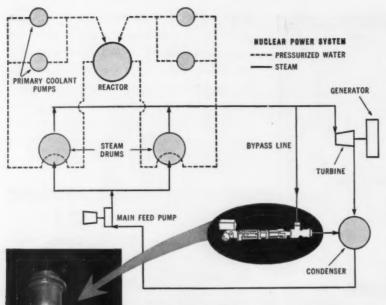
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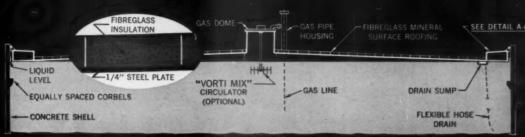
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theories and clarify the meaning of empirical data and describes the application of fundamentals to realistic problems commonly encountered by the soils engineer in everyday practice. It tabulates average soil properties wherever such information is necessary, and explains how soil data are obtained.

BEACHES AND COASTS, by Cuchlaine A. M. King; St. Martin's Press, Inc.; New York, N. Y.; \$14.50. This book is concerned with processes at work on the coast and the evolution of different coastal areas. Examples are taken from the beaches and coasts of Great Britain, Scandinavia, France, the Mediterranean area, Australia, New Zealand, India, Canada, and the United States. The book is especially written for civil engineers and others engaged in research or planning on the beach and coast. It covers such topics as methods of research, waves, beach profiles, effect of wind, coastal erosion, historical data on coastal change, and coastal types and their development - the marine cycle.

THE ASPHALT HANDBOOK, revised edition, Manual Series No. 4, March 1960; The Asphalt Institute, College Park, Md. This is a new and completely revised edition of the Asphalt Handbook, standard reference work in the field of asphalt technology and construction. The handbook is made up of uses of asphalt, terms relating to asphalt and its uses, tests, specifications and principal recommendations, thickness design of asphalt pavement structures, asphalt construction equipment, construction of asphalt pavements, stage construction, reconstruction and maintenance, roadway appurtenances, asphalt surfaces on bridges, railroad usage, paved parking areas and driveways, asphalt in hydraulics, miscellaneous uses of asphalt, and many useful tables and miscellaneous information. Very thoroughly illustrated.

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- 1. It is a statically determinate structure in which the weighted pontoon is a structural member designed for torsion, bending and compression.
- 2. Its design is simple. Rectangular plates are field welded into a single deck to which a protected insulation is directly applied. The pontoon structure with single roller guide banishes possible side thrust on the tank wall.
- 3. The "plate and pontoon" design minimizes tip and makes submergence impossible.

- 4. Up to 60 feet in diameter, the "MONODECK" cover can be assembled complete outside the tank and lifted by the contractor's crane into position. Tank and cover can therefore, be constructed simultaneously. Savings in erection costs may be as much as 50% on the larger covers.
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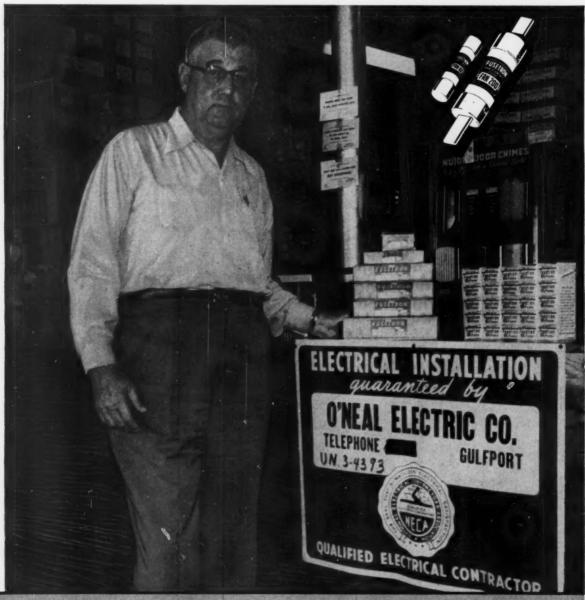
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"We helped a customer stop frequent outages and get safe motor protection... by recommending FUSETRON Fuses"

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Play Safe! install FUSETRON dual-element FUSES



Mr. O'Neal continues.

"Sometime ago, the Gulfport Ice Co., called us in to do their electrical maintenance work. At the time, they were having a great deal of difficulty with motor starting currents causing ordinary fuses to blow. They were using 100, 200 and 400 amp. ordinary fuses to protect the motors.

"These frequent outages disrupted the company's normal operation and created a costly and annoying situation. Just to replace the 400 amp., 250 volt ordinary fuses was costing them about \$40 a month.

"My first recommendation to them was to change to Fusetron dual-element fuses in the proper size for safe motor protection. They did.

"The installation of Fusetron fuses was the 'key' to the problem. In the past five years I do not recall one 400 amp. Fusetron fuse having blown — and outages on the 100 and 200 amp. circuits have been very infrequent."

YOU TOO, CAN GUARD AGAINST UNNECESSARY OUTAGES OR MOTOR BURNOUTS THAT CAUSE MEN AND MACHINERY TO STAND IDLE SIMPLY BY INSTALLING FUSETRON DUAL-ELEMENT FUSES THROUGHOUT THE ENTIRE ELECTRICAL SYSTEM.

In addition to saving you money by protecting against needless outages and motor burnouts

FUSETRON Fuses offer High Interrupting Capacity and Life-Time Dependability Essential to Modern Protection.

High Interrupting Capacity: With electrical network capacities steadily increasing, — a modern protective device must be capable of interrupting the heavy fault currents now available and to be adequately safe to allow for anticipated growth in service demands.

FUSETRON fuses give you this protection. They have an exceptionally high interrupting rating of 100,000 amperes rms symmetrical.

Life-Time Dependability: The increase in available fault currents has emphasized the need for dependability in modern protective devices, otherwise, serious fire and personal injury can result should the device fail to operate when an emergency arises.

FUSETRON fuses provide safe and accurate protection through the years as their operation depends on a simple thermal law. Unlike mechanically operated devices, Fusetron fuses have no hinges, pivots, latches or contacts to stick or get out of order.

Once properly installed, Fusetron fuses require no maintenance, — no periodic inspection and accompanying down-time.

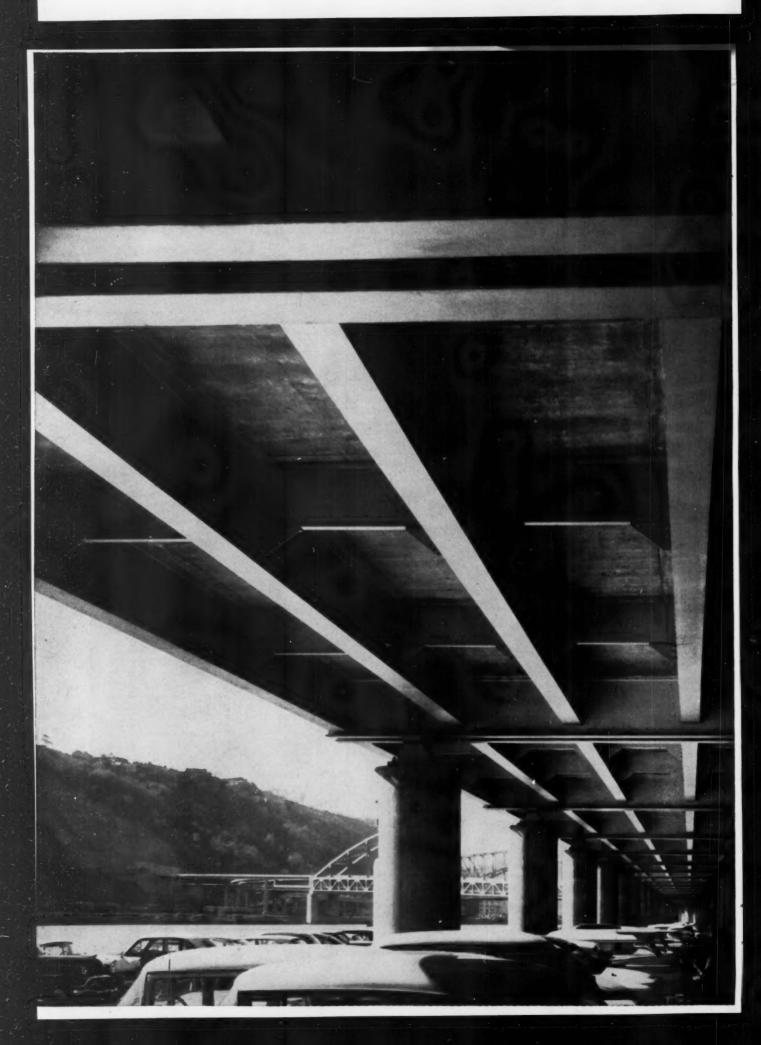
If you are considering a new installation or the modernization of an electrical system — you can be sure of modern, safe, maintenance-free protection in 10 or 20 years by installing Fusetron dual-element fuses now.

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AND THE COMBINATION OF (IS) HIGH-STRENGTH STEEL WITH CARBON
STRUCTURAL STEEL CUTS WEIGHT, REDUCES COSTS AND INCREASES CLEARANCES

Here are three cases where the use of USS MAN-TEN Brand of High-Strength Steel in short-span bridges resulted in weight reductions up to 29% and substantial savings in cost. The depth of the stringers was reduced from 36 inches to 33 inches in some instances, by designing to permissable allowable stresses of 24,000 psi for USS MAN-TEN Steel compared to 18,000 psi for A-7 steel.

All three jobs are parts of the Penn-Lincoln Parkway East in downtown Pittsburgh. A total of 4,250 tons of USS High-Strength Steel combined with 695 tons of A-7 steel, using both strength levels as good design dictated, were used to construct these modern over-passes and elevated structures. The designer and engineers were Richardson, Gordon & Associates, Pittsburgh, and the General Contractor, Fabricator and Erector was Fort Pitt Bridge Works, Pittsburgh, Pa. Concrete Contractor: John F. Casey Company, Pittsburgh, Pa.

United States Steel makes steel of high-strength levels for a wide variety of applications: USS Manten, USS Corten, USS Triten Brands (50,000 psi minimum yield point), USS "T-1" Constructional Alloy Steel (100,000 psi minimum yield strength), in addition to a complete range of carbon and stainless steels. For more information, write United States Steel, 525 William Penn Place, Pittsburgh 30, Pennsylvania.

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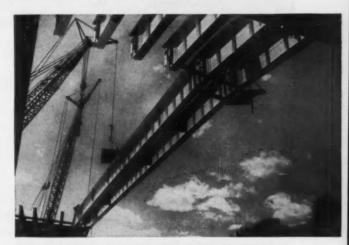
United States Steel Corporation — Pittaburgh Columbia-Geneva Steel — San Francisco Tennessee Coal & Iron — Fairfield, Alabama United States Steel Export Company United States Steel Export Company

United States Steel

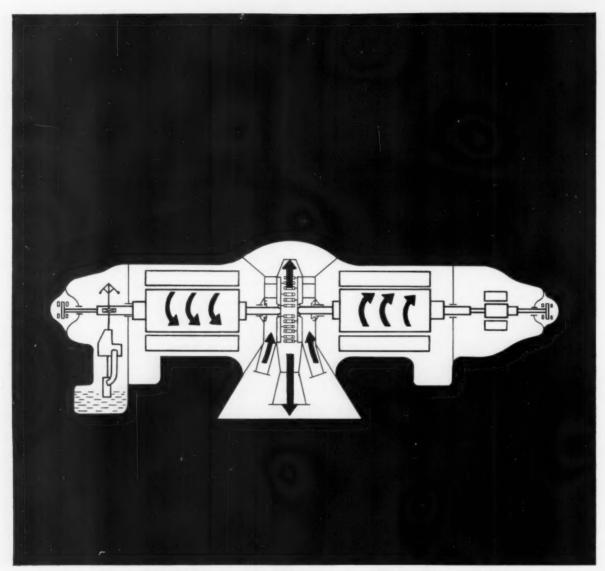
◆ COST REDUCTION. A typical 54-foot USS MAN-TEN Steel wide flange structural (33 inches deep) used as a stringer in this section costs \$41.85 less than one made of A-7 steel (36 inches deep). With 28 spans and 140 such stringers between Stanwix and Grant Streets, in Pittsburgh's Penn-Lincoln Parkway, the total saving in favor of USS MAN-TEN High-Strength Steel is \$5,859. Weight savings were 23½% in the stringers, and their depth was reduced three inches compared to the depth of the member that would have been required had A-7 steel been specified. Deflection requirements of the end cross girders in this, as well as other portions of this part of the Parkway, were such that A-7 steel was the more economical grade for these parts.
Material costs (f.o.b. mill) and weight savings calculated by United States Steel.



29% WEIGHT SAVING. This curved ramp off Grant Street has 7 spans of 65 feet and 1 span of 77 feet using 850 tons of USS MAN-TEN High-Strength Steel and 100 tons of A-7 steel. Simple rolled beams of high-strength steel were possible instead of built-up plate girders of A-7 steel. This is responsible for a large reduction in weight and cost. Again, due to deflection requirements, cross members were A-7 steel.



GREATER STRENGTH—MORE CLEARANCE. Westbound Parkway ramp near 10th Street, crossing B&O freight yards. A good application where MAN-TEN High-Strength Steel reduced the depth of the girders, providing greater clearance. This section has 12 spans: 9 simple span plate girders 130' x 66" deep and 3 anchor plate girder spans with cantilever arms 180' to 199' end to end x 66" deep. 3,100 tons of MAN-TEN Steel were used in the girders and 560 tons of A-7 steel were used for expansion dams, diaphragms and shear locks. Weight savings estimated—about 26%.



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U.S. Representatives DeLaval-Ljungström Turbine Co.



Reporting

The New Projects

Fiber Pipe Drops Water Table

When test borings showed a permanent water table as much as 30 inches above the surface of the proposed basement floor slab for a new First National Store at Hingham, Massachusetts, consulting engineers had to decide between waterproofing and drainage to lower the water table. Sumner Schein, Boston architect-engineer and Haley & Aldrich, Cambridge soil engineers, decided to eliminate hydrostatic pressure through an underdrainage system.

Approximately 400 feet of 6-in. Bermadrain pipe was used for both the drainage collection system



Bermadrain perforated pipe dropped water table below basement floor level on store construction project.

and runoff to the disposal area. Solid unperforated pipe was used for the runoff line and perforated pipe for the drainage collection system. This latter pipe is designed with 5/16-in. holes placed at a 120 degree angle, three inches apart. The holes are placed down so that water can enter freely.

Benefits from use of the underfloor drainage system were the elimination of waterproofing and the design of a much thinner floor slab. This resulted in a saving of \$1.40 per square foot, or approximately \$18,000 for the 13,000-sq ft basement floor



area. Cost of the fiber pipe used in the drainage system is estimated at approximately \$400.

Verrazano-Narrows Bridge Construction

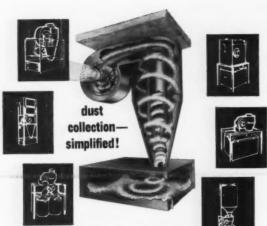
Almost a million pounds of manganese-vanadium high strength steel will be sunk approximately 130 to 200 feet below the river bottom to support the high towers of the Verrazano-Narrows Bridge. These huge assemblies, known as caisson cutting edges, are being fabricated by the Elizabeth Iron Works, Inc. Each of the two cutting edges consists of 28 subassemblies varying in weight from 13 to 20 tons and measuring approximately 60 feet in length, 6 feet in width, and 8 feet in height. When welded into position, the rectangular cutting edge covers an area of 30,000 square feet.

The Verrazano-Narrows Bridge was designed by Ammann and Whitney and is being erected under the direction of Steers-Snare, a joint venture of J. Rich Steers, Inc. and Frederick Snare Corporation. It will have the longest suspension span in the world — 4260 feet clear. The bridge itself will be 6690-ft long and will be supported by two steel towers 690-ft high. Total cost will be in excess of \$300 million. Completion is scheduled for 1965.

Deepwater Wharf for Alaska

Construction of a deepwater wharf to serve as sea terminus of the 22-mile pipeline from the new oil field on Alaska's Kenai Peninsula has been awarded to a joint venture of J. H. Pomeroy & Co., Inc. and Ben C. Gerwick, Inc. The wharf and supporting facilities were designed by Earl & Wright, a San Francisco engineering firm. Cost of the project is \$1.3 million.

The wharf will be 900 feet in over-all length, and is designed to handle 28,000-ton tankers. The structural steel and reinforced concrete structure will have a central breasting platform 250-ft long and 50-ft wide. Four mooring dolphins, two on each side of the platform, are connected with the



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central platform by walkways. The breasting platform will be linked to shore by a 1000-ft causeway with a 14-ft wide roadway and a 6-ft wide pipeway. Supports for both the wharf and causeway will be provided by steel pipe cylinders ranging from 5 to 8 feet in diameter, some of them more than 110-ft long. The cylinders will be driven approximately 40 feet below sea bottom, and filled with compacted sand and capped with concrete. Depth of water alongside the wharf will be 40 feet at low tide.

Disposal of Ships' Garbage

During the design of a \$5.4 million sewage collection system and treatment plant to serve the Mare Island Naval Shipyard, Quinton Engineers, Ltd., of Los Angeles, and the sanitary engineers of the Dis-



Ship's garbage is treated with 15-psi steam in trailer mounted tank used to haul it to landfill disposal area.

trict Public Works Office of the Twelfth Naval District, encountered a rather unique problem in the disposal of ships' garbage.

The specific problem at Mare Island was to develop a suitable method for disposing of approximately 1500 tons of ships' garbage per year which was being ground up at a central grinding station and discharged untreated into Mare Island Strait. Although the California State Department of Agriculture approved of this practice, it did not meet with the approval of the Regional Water Pollution Control Board.

The sterilization of the garbage by the use of steam was discussed with officials of the State Departments of Public Health and Agriculture. As the result of these discussions, Dr. Stuart of the Department of Agriculture set up an Inter-Departmental Subcommittee on Ships' Garbage Disposal,

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FEderal 3-3177 Thomas P. Ryan, mgr. and a program of basic research was started. The result of this research indicated that the disease-causing organisms could be destroyed only if subjected to a temperature of 212 F for two hours. Once the infected, or potentially infected, garbage is sterilized it can be placed in a sanitary landfill.

It was decided to proceed with the design of facilities based on the use of a trailer-mounted tank in which the garbage would be heated by steam. The ships' garbage is trucked to a central station where it is dumped into a storage hopper. The garbage passes from the hopper through a trough where large cans and other metallic objects are picked out. It then discharges into a specially constructed, 600-cu ft capacity, trailer-mounted, cylindrical tank built by the Daly Body Company, of Oakland, California. The garbage is continuously mixed by an engine-driven agitator rotating at 6 rpm while 15-psi steam is injected into the vessel to keep the contents above 212 F for two hours. At the end of two hours the trailer-mounted tank is hauled to the sanitary landfill site and the garbage discharged through a hydraulically operated gate. A temperature recorder at the central station provides a record of the sterilization temperature.

Iowa State Gets Research Reactor

Congress has authorized \$3½ million for the construction of a laboratory and reactor building for the Ames Laboratory on the Iowa State University campus at Ames, Iowa. The Atomic Energy Commission has awarded the project to Burns and Roe, Inc. Nuclear design services for the 5000-kw research reactor itself will be handled by AMF Atomics, a division of American Machine & Foundry Company.

The new reactor will be of a thermal heterogeneous type, using highly enriched uranium fuel. It will be cooled and moderated by heavy water. The reactor is intended for research in a variety of fields including nuclear and solid state physics, chemistry, activation analyses, and engineering. Intense beams of neutrons will be used in the study of crystal structure and radiation damage.

More Efficient Power Production

The nation's largest combined cycle steam-gas turbine electric power generation station will be completed for the Oklahoma Gas & Electric Company sometime in 1963. The new plant is expected to be at least four percent more efficient than a comparable conventional power plant of similar capacity. The over-all contract has been awarded to the General Electric Company which has in turn retained Sargent & Lundy to design the plant.

Oklahoma Gas & Electric pioneered in the installation of gas turbine units for electric power

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of comfort

to St. Louis' Jet-Age Airport





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Another touch of comfort was added recently with the year-round air conditioning of the three "fingers", or covered walkways, extending from the main building to areas where planes discharge and take on passengers.

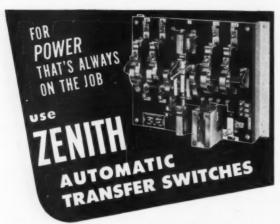
Two hundred and twenty-three Marlo "Seazonaire" remote fan coil units of 300 to 800 cfm were installed by Guaranteed Heating and Engineering Company. Using chilled or heated water from a central source, these compact units provide perfectly conditioned air in summer and winter. Consulting engineers for the installation were Ferris & Hamig.

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generation in the United States. Two 3500-kw units were installed in 1949 and 1952 at the company's Belle Isle Station. These units have been studied by engineers from all over the world in their investigation of new techniques for power generation.

Composite Design for New Plant

A new 1146-ft by 280-ft, two-story structure, for Steelcase, Inc., will be the first building in the Midwest to utilize the advantages of composite design. The building was designed by J. and G. Daverman Company, Grand Rapids architectural and engineering firm.

Composite construction is presently being researched at Lehigh University. Designers used AISC and AASHO specifications as the criteria for



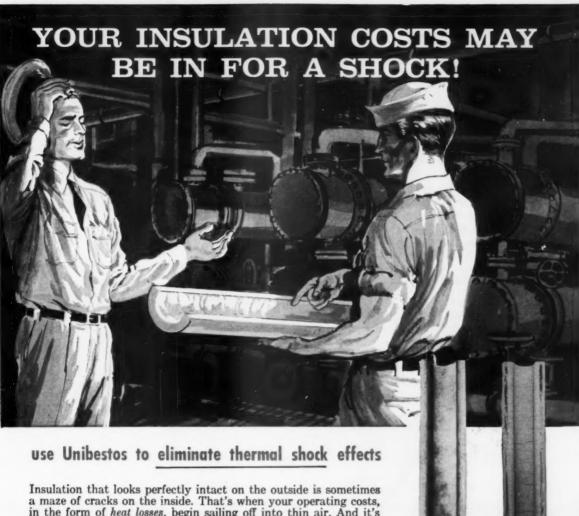
Composite design was used for new 1146-ft by 280-ft, two-story structure designed by J. and G. Daverman.

their Steelcase design. The steel was fabricated by Haven-Busch Company, of Grandville, Michigan.

Thirty-four hundred tons of steel were used in the building with over 12½ miles of welding used to fasten the channel shear connectors to the top flanges of the beams. It is reported that the savings in the Steelcase structure will run between 20 and 25 percent for the floor beams and girders.

Fully Air Conditioned Shopping Center

Constuction is well under way on the Chris-Town Shopping Center in Phoenix, Arizona. Designed by Welton Becket & Associates, it will be one of the nation's first completely air conditioned shopping centers. Not only the 600,000 square feet of shops, but even the 50,000-sq ft central mall will be air conditioned. All shops will have open fronts, featuring sliding glass doors or roll-up screens, and the air conditioning will be equalized throughout.



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Microstraining for Denver's Water

Following successful testing begun in May 1958, the consulting engineer firm of Phillips-Carter-Osborn, Inc. has designed a microstraining installation for the Denver Water Board which will handle 120 million gallons of water per day. The machines consist of revolving drums covered with woven stainless steel fabric having apertures as fine as 23 microns. Microorganisms and suspended matter in the water are deposited on the inside of the drum as the water passes through. These then are washed off by jet sprays into a waste hopper which discharges into a hollow axle. Microstrainers are made in Scotland by Glenfield & Kennedy, Ltd., and have been specified recently on a number of North American projects.

United Engineering Building

The welded steel framework of the United Engineering Building was topped out last month. Among the interesting structural members are the seven, 41-ft girders which form a span over the reference library. These 10-ton units have a center section flange of 3-in. plate, with the two end sections in 2-in. plate. These are welded with 45



One of seven, 41-ft steel girders which will span reference library of the United Engineering Building.

degree bevel joints. Web plate is 40" x %" x 41'-6", with heavy web reinforcements welded around the cutout made to clear duct work and plumbing.

Work on the building is under general contract to the Turner Construction Company, with fabrication and erection of the steel framework by the Dreier Structural Steel Company of Long Island City. Structural engineers were Seelye Stevenson



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One ingenious, pleasant and immensely practical way to get people to enjoy an island park is to carry them there through the air. Starved Rock Airpark Inc. did just this by erecting a passenger tramway that "flies" over the Illinois River. The owner reports the facility has met with considerable success—both from an aesthetic aspect as well as that of moving people from one point to another.

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Value & Knecht, and the architects are Shreve, Lamb and Harmon.

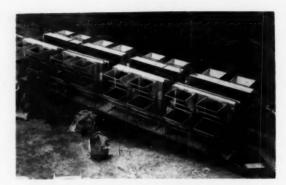
World's First Tidal Power

The French Electricity Authority has turned out detailed plans for the harnessing of tidal power on an almost yearly basis since 1950. However, its latest plan probably will be allocated the \$85 million of public money required. Construction is expected to begin in Brittany, early next year.

Plans call for the damming of the River Rance, two miles upstream from St. Malo. The tide will flow in and out through 24 turbine-generator units, each of which will produce 10,000 kilowatts. It is estimated that the Rance station will produce 567 million kilowatt-hours a year. Since tide times can be forecast exactly, production plans can be made many years in advance. Thus, it is planned to feed power from the Rance project into the national grid at times when power is most expensive. Turbines are designed to work effectively even when there is a difference of only three feet between the level of the dam water and the sea. Maximum difference is estimated to be about 40 feet.

Air Conditioning in the Canal Zone

Because of maintenance problems with electronic equipment and furnishings, the Panama Canal

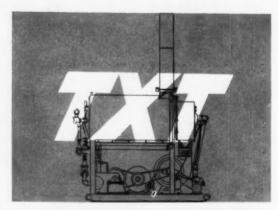


Unicon condensers serve refrigeration units which air condition the offices of the Panama Canal Company.

Company recently air conditioned its offices at Balboa in the Panama Canal Zone. Consulting engineer on the project was R. L. Duffer & Associates, of Miami, Florida.

The firm, which has had wide experience in the caribbean area, finally selected a 500-ton dry condensing system. This eliminated the termite problem with wooden cooling towers; and the frequent clogging of circulating pumps, nozzles, sumps, and the condensing units which would result from the abundance of airborne life in the tropical region.





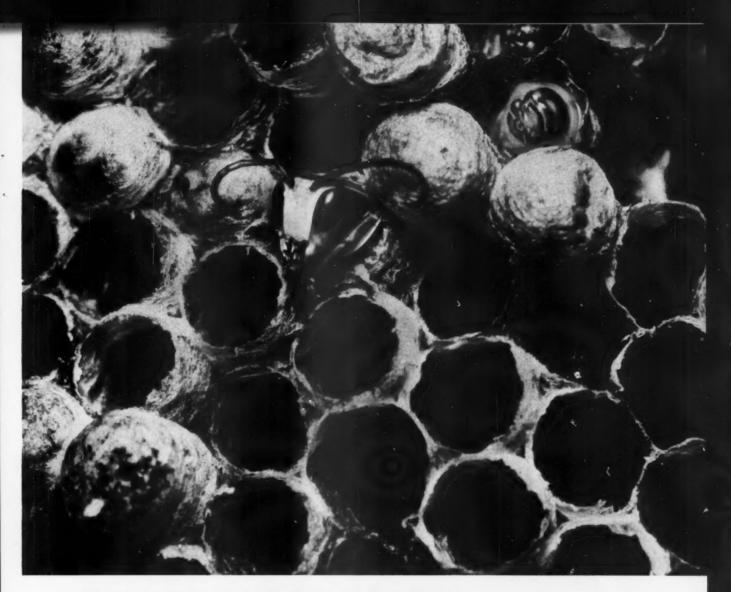
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The refrigerating system, which extracts six million Btu per hour (500 tons) from the water chilling circuit, consists of four 125-hp direct-drive Carrier compressors with unloaders and two double-circuit direct expansion water chillers. Each compressor uses one Kramer Trenton Unicon for condensing. The latter units are installed outdoors about 100 feet from the building containing the compressors. Their coils and casings, formed of heavy gauge aluminum sheet and copper tubing, require no maintenance and will not corrode.

Russian Canal Building

A Russian engineer has proposed a plan which would reduce the length of the Northern Sea Route and shorten the journey from Archangel or Murmansk to Vladivostok by nearly 3000 km. At the same time it would almost double the length of the navigation season. The new route would follow inland waterways and require a canal project with twice the excavation work involved in the construction of the Panama Canal. Power stations and reservoirs would be built along the route. It is estimated that the project would pay for itself in a period of 20 years.

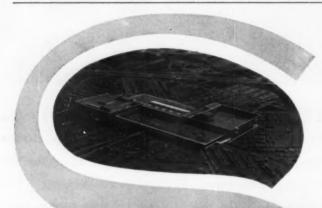
Meanwhile, another Soviet waterway linking the Arctic with the Mediterranean is expected to be complete by 1965. It will lead through the heart of European Russia over 2000 miles of giant canals, reservoirs, and rivers. Large ocean-going cargo ships will carry 10 times as much cargo from the Arctic to the Black Sea as they did in the past.

The main link in the network is the Baltic-Volga canal. It will take ships 225 miles inland from Leningrad in 48 hours. The biggest man-made seas on this route are the Kuybyshev Sea, 375-miles long, the Stalingrad Sea of equal area, and the Gorky Reservoir.

Novel Roof for Opera House

Thirty concrete shells will form the novel roof of the new opera house on Bennelong Point in Sydney Harbor. The \$12 million structure will have its roof covered with white ceramic tiles. The building is the concept of Danish architect, Joern Utzon, and the consulting engineer is Ove Arup and Partners, of London.

Some of the shells in the 216-ft high building will lean forward like huge poke bonnets to face the main entrance and a paved concourse, with car parking underneath. Others face the opposite way, towards the harbor. On the open sides the shells will have louvered walls or glass screens. Inside, the halls will not follow the lines of the shells, but will have flat ceilings and interior walls panelled with natural timbers.



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Vent and Drainage—Time-tested galvanized steel pipe gives assured maintenance-free service at low cost. That's why it is specified for drainage and vent lines in major buildings such as Cleveland's Illuminating Building, New York's Coliseum, the Seagram skyscraper and Socony-Mobil and Mutual Benefit Life Buildings.



Snow Melting—Beneath the toll gates of the Indiana Turnpike and the Calumet Skyway, as well as on the ramps of the New York Port Bus Terminal and Staten Island Ferry, steel pipe keeps pavement approaches clear of ice and snow for safe and controlled vehicular movement all winter through.

Steel pipe serves best in many ways...



Radiant Heating and Cooling—In Salt Lake City's First Security Building, steel pipe serves a dual function. It carries steam for heating and chilled water for air conditioning. Logically, too, for steel pipe has proved efficient for heating and refrigeration, as well as icemaking, in over 70 years of service.



Electrical Conduit—When vital services depend on electricity, as in Chicago's Commonwealth Promenade Apartments, it's natural to protect this power with sturdy, rigid steel conduit. Imbedded in concrete, enclosed in walls or exposed—rigid steel conduit meets all local, state and national building codes.



.. many places

Steel pipe is the modern metal tubular product easy to engineer and install.

Indoors or out, overhead or underground, in walls or exposed—steel pipe means durability and economy. It's easy to work, economical, readily available. It meets local, state and national codes. Its proved record of performance makes it the most widely used pipe in the world.

Steel pipe serves well and long in vital services affecting American life and business... for vent and drainage, fire sprinkler systems, snow and ice melting, radiant and conventional heating, air conditioning and gas, air, electrical and water lines.

In many ways and many places steel pipe serves best. To learn about how, why and where—consult your local steel pipe distributor or steel company representative or write the Committee's Research Engineers for specific application literature.

Fire Prevention—Much of the nation's \$1,100,000,000 annual fire losses might have been prevented if all structures were equipped with efficient, steel pipe fire sprinkler systems. The cost of such built-in, 24-hour fire protection, when related to potential losses, is truly an economical investment.

STEEL PIPE IS FIRST CHOICE

- · Low cost with durability
- Strength unexcelled for safety
- Formable—bends readily
- · Weldable-easily, strongly
- · Threads smoothly, cleanly
- · Sound joints, welded or coupled
- · Grades, finishes for all purposes
- Available everywhere from stock

Insist on



Steel Pipe

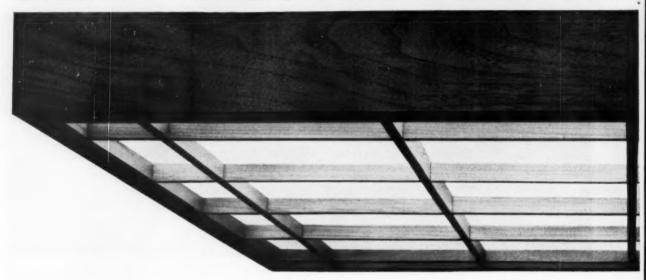
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COMMITTEE OF STEEL PIPE PRODUCERS

150 East Forty-Second Street, New York 17, New York

This is the embodiment of a design philosophy... a blending of function with aesthetics ... an imaginative application of appropriate materials to good lighting. The product is *Corona*, an appealing new treatment for fluorescents that transforms them into an effective decorative element. A wonderfully warm walnut frame surrounds the diffusing pane, while handsome birch

NEW! FLUORESCENTS



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Jersey City 5, New Jersey Showrooms: New York, Chicago, Dallas, Los Angeles

Corona is stocked by these Authorized LIGHTOLIER Distributors:

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ARKANSAS Listic Rock: Adooch Ltg. & Sup. CALIFORNIA Sam Francisco: California Elec. Sup. Co.

COLORADO
Denver:
Contral Elec. Sup. Co.

CONNECTICUT
Bridgeport:
B. M. Tower Co., Inc.
Harripord:
Beacon Light & Sup. Co.
New Haven.
Sup. Co., United Harripord:
United Elect. Sup. Co.,
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DISTRICT OF COLUMBIA Washington: Maurice Elec. Sup. Co. Mational Elec. Wholesalers

FEORIDA Miami: Farrey's Whise, Howe, Co. GEORGIA Atlanta: Electrical Wholesalers

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INDIANA
Ft. Wayne:
Mossman-Yarnelle Co.
Gary:
Englewood Elec. Sup. Co.
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Dos Moines:
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Bessen:
Mass. Gan & Elec. Light Ce.
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> MONTANA Great Falls: Glacier State Elec,

NEBRASKA
Lincoln:
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Electric Fix. & Sup. Co.

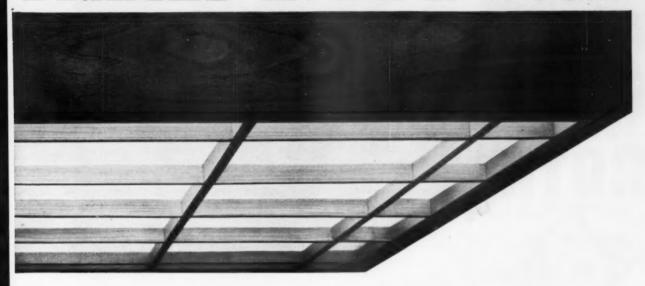
NEVADA Remo: Western Elec. Dists. Co. NEW HAMPSHIRE Portsmouth: Mass. Gas & Elec. Light Co.

NEW JERSEY
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Charry HillDolaware Township:
Flynn's Camden Elec. Fix. Co.

NEW MEXICO
Albuquorque:
The Lighting and Main. Co.

NEW YORK Binghamton: Freije Elec. Sup. Co. Buffalo: Buffalo Incand. Light Co. Inc. Niagare Falls: Hysen Supplies Inc. baffles cut a pleasing modular pattern across its surface. The feeling is one of warmth and friendly informality . . . contemporary in styling, yet completely harmonious with traditional decor, residential as well as commercial. Optically, Corona is all that one might expect from a fine lighting instrument engineered by Lightolier. In four sizes: 54" x 54", 30" x 30", 32" x 54", 16" x 54".

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To learn more about Corona and other surface and pendant fixtures, write today for a complete brochure to Dept. CE9

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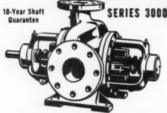
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TURBINE POWER PLANT PUMP



PACKAGED BOILE



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CERTIFIED HOT WATER PERFORMANCE

Long, efficient, trouble-free operation under the most adverse conditions of usage, plus a wide range of stock models and capacities, have made ROTH Turbine Power Plant Pumps and Packaged Units the choice of thousands of heating engineers. The pumps are recognized for their superior hot water performance, (capacities and pressure certified upon request). Shafts are guaranteed for ten years against breakage. Cast iron or copper-bearing steel available on all vertical and underground units. Motors and controls of nationally accepted makes.

ROY E. ROTH COMPANY

TURBINE PUMP DIVISION
2450 Fourth Ave. Rock Island, Illinois

The High Spots

OUTLAYS for plant expansion, according to James C. Downs writing for The First National Bank of Chicago, have tended to decrease gradually in the past several months, and the pressures for reduction of public building are even more meaningful at the state and local level than they were at the beginning of the year. Estimates for the construction industry for the last six months of 1960 compared with the last six months of 1959 are as follows:

¶ Industrial building — up 20%. ¶ Institutional building — unchanged.

¶ Repairs and maintenance – up 8%. ¶ Public construction – down 8%.

Electronics Who's Who

The Scientist and Engineer Technological Institute announces the publication of a Who's Who Directory in the Electronic Industry in the fall of 1960. Scientists and engineers on all levels will be included, as well as other key personnel in leading firms. Applications for inclusion should be sent to the Scientist and Engineer Technological Institute, Box No. 370, New York 21, New York. Selection of the biographies submitted will be made at the discretion of the editorial board.

Promoting the Profession

To give children an insight into civil engineering and to draw some of them into the profession, Lockwood, Kessler & Bartlett, Inc., Syosset, New York, engineering firm, has undertaken an introductory program for junior high school pupils. The first to visit LKB were 28 top-ranking ninth graders of the Great Neck, New York, Junior High School, who spent a day

there. The Great Neck students had an opportunity to see the photogrammetric process whereby matched pairs of aerial photos are read on stereoplotting instruments so that roads, bridges and other physical data, as well as topographic information, is transferred to map paper.

Each child was furnished with material on photogrammetry, literature on civil engineering and on major projects undertaken by Lockwood, Kessler & Bartlett, and an aerial photograph showing how their school and its environs appear from an altitude of 12,000 feet. "A child with a hankering to create, with a practical mind, and reasonably good in mathematics is the potential engineer," Bartlett said. "For some unexplained reason, some pre-college educators and parents have been under the mistaken impression that opportunities are lacking in engineering. The reverse is true, there are not enough to fill current needs and the lack is getting greater yearly."

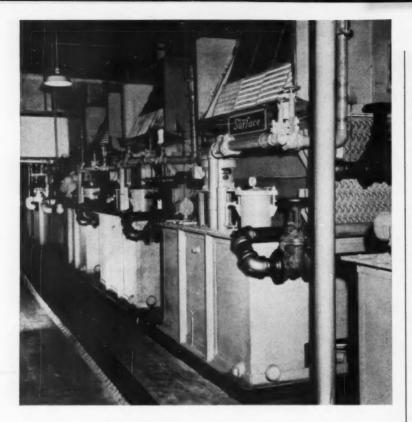
1960 Construction in Canada

Planned construction in Canada in 1960 is estimated at a record \$7317 million, some 2.6 percent above the previous high of \$7129 million in 1959. The increase anticipated for 1960 over 1959 compares with gains of 0.5 percent in 1959, 1.0 percent in 1958, and 8.8 percent in 1957.

The 1959 program gained in most areas over the previous year, but these gains were offset by substantial declines in marine construction and gas pipelines, owing to the completion of work on the St. Lawrence Seaway and Trans-Canada Pipe-Line projects.

The increases in spending for 1960 are concentrated in non-





120 GRAINS CUT TO 45 IN 200,000 cfm OF AIR WITH 85° TOWER WATER

Without Kathabar, this job would have taken 1800 tons of refrigeration, at about 35F and reheating air from about 45F to 98F! With Kathabar the job took 63 hp instead of 2000. Ask the men who have seen Kathabar Type C units serve for years with practically no maintenance. Write for specific information.

Surface

SURFACE COMBUSTION

Division of Midland-Ross Corporation 2398 Dorr St., Toledo 1, Ohio
Send facts on Kathabar systems for the following application:

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company	
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city	zonestate

residential building structures; engineering and residential construction are expected to be about level in both 1959 and 1960. Within the engineering category, moderate increases in road building, water and sewer works, and in telephone facilities will be offset by equally moderate declines in marine and railway construction and in the building of power facilities.

Engineering Index Available

The Engineering Index, published by the Engineering Index, Inc., 29 West 39th Street, New York 18, is available in the 75th edition for \$70. It contains over 39,100 annotations of articles reviewed in some 1700 publications of engineering, scientific, and technical societies; engineering and industrial periodicals; and publications of government bureaus, engineering experiment stations, universities, and other research organizations. Selection of articles appearing in these publications is made on the basis of how they deal with the art and science of engineering. Articles on pure science, economics, commerce and trade, editorials, news items, notices of meetings, trade announcements, and similar material are omitted if not considered of primary importance.

Radar Tracking Station

Burns and Roe, Inc., New York City engineers and constructors, has received a contract to handle site preparation, site facilities, and construction for Project Mercury. This is the United States effort, under the direction of the National Aeronautics and Space Administration (NASA), to achieve orbital manned flight. The company is one member of a team, with Western Electric Company, Inc. as prime contractor, charged with over-all supervision of the tracking network to be built.

Stations are being built at 17 locations around the world, equipped with voice communication, radar, and telemetering equipment for

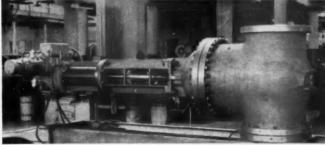
DARLING SPECIALIZES IN SPECIAL VALVES



10" Stainless Steel cylinder-operated, 150 lb. gate valve equipped with special limit switches



Steel Valve for automatic fail-open operation.



High temperature Stainless Steel Valve, produced for a large overseas petrochemical plant.

FLEXIBLE thinking

> RIGID quality control

INTEGRATED engineering-production

> CLOSE TOLERANCE machining know-how

Here you see special valves engineered and produced by Darling to meet unusual service requirements. Wherever you face problems involving high temperature, emergency opening or closing, unusually-high pressures, highly corrosive conditions ... call on Darling.

Our broad range of sizes, pressure classifications and operating mechanisms can often be readily modified to meet your service needs. Or we can design and produce special valves "from scratch" when required. Send us your specifications for recommendations and quotes.

DARLING VALVE & MANUFACTURING CO.

Williamsport 5, Pa.

Manufactured in Canada by Sandilands Valve Manufacturing Co., Ltd., Galt 19, Ontario





Protect against power blackouts...

KOHLER ELECTRIC PLANTS

Widespread hazards, inconvenience, discomfort and loss occurred in places without standby power during the 13-hour power failure in New York's Manhattan last summer. Hospital surgery was performed without proper lighting; patients were served by candlelight. Buildings of many kinds had no use of lights, air conditioning, elevators, freezers.

Kohler electric plants are reliable, easy to install for emergency power made vitally important by today's increasing dependence on electrical equipment. To help you write specifications for varied applications, Kohler Co. will send on request a manual with complete data on sizes from 1000 watts to 100 KW, gasoline or diesel.

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KOHLER CO.
Established 1873
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MODEL 100R81
100 KW, 120/208
volt AC.
Stand-by.
Remote start.

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Enameled Iron and Vitreous China Plumbing Fixtures • All-brass Fittings
Electric Plants • Air-cooled Engines • Precision Controls

contact with the astronaut. More than 300 Burns and Roe staff members will participate in this undertaking at peak activity, believed to be the largest peacetime global construction effort ever attempted simultaneously. Africa, Australia, Grand Bahama Island, Hawaii, Grand Canary and Grand Turk Islands, Bermuda, Canton Island, and even the Indian Ocean, are some of the faraway places that personnel responsible for selecting tracking station sites have investigated.

Air Conditioning Manual

Designed to bridge the gap be tween air conditioning texts and manufacturers' catalogs, Volume III of the Carrier Corporation's Engineers Manual is now available. It is a practical reference on air conditioning and refrigeration entitled "System Design." Designed as a sectional book, the manual eventually will include 12 parts and some 750 pages.

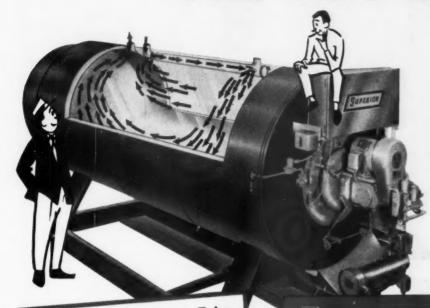
Legislated Highway Route

Representatives of the Oklahoma Turnpike Authority pointed out that the proposed southwestern toll highway location was required by law to run within two miles of the Chickasha city limits. The report was prompted by a reservation in the state highway department's approval of the proposed route. De Leuw, Cather & Company is the engineering firm on the project. According to a report by Wilbur Smith and Associates the pike will bring in an annual revenue of almost \$3.5 million the first year, and the figure probably will increase thereafter.

New BRI Publications

Two new publications are available from The Building Research Institute. "The Current Status of Modular Coordination," Pub. No. 782, 38 pp., illustrated, list price \$2.50; and "Design Potential of Metal Curtain Walls," Pub. No. 788, 92 pp., illustrated, list price

look what's happened to hot water boilers!



No, we're not making them with windows... we did that in the illustration to show you our NEW Venturi-action Mixing Tube which is the talk of the industry.

Venturi-Action Mixing Tube plays a triple role:

It starts by mixing entrained water from the boiler with water entering the boiler.

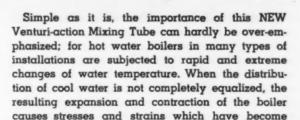
2 Traveling through the tube, the temperature is further modified by the surrounding

Jet action at the end of the tube directs flow downward and outward against the outer confines of the shell, providing a circulation pattern unequalled in any other hot water boiler.



For details of Superior's Hot Water Boilers in sizes to 350 BHP write for catalog CCW-13. For sizes from 400 to 600 BHP write for catalog CFW-13. 10 F

known as Thermal Shock.



No hot water boiler can be made to withstand severe and repeated Thermal Shock . . . but this new Superior Boiler is designed to reduce it to a minimum.

Available in sizes to 600 BHP, Superior's Hot Water Boiler is the answer to trouble-free hot water heating.

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Reading liquid levels got you out on a limb?

Not if an easy-to-read Liquidometer Gauge is used to indicate exact levels at a glance. It's as simple as telling time...ends potentially dangerous dip-sticking.

Liquidometer Gauges enable one man to read liquid levels safely and precisely—keeping a continuous, right-at-hand inventory—without risking life and limb.

Take the hazards out of liquid measurement—save time, too—by installing reliable Liquidometer Gauges. There is a type available for practically every liquid measuring application.

For complete details, write

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\$5. They may be ordered from the Division of Engineering and Industrial Research, 2101 Constitution Avenue, Washington 25, D. C.

City Planning Fellowship

A research fellowship in city planning has been established by Harland Bartholomew and Associates, city planning consulting firm, at the School of Fine Arts of the University of Pennsylvania. Establishment of the fellowship was announced by G. Holmes Perkins, dean of the school. In addition to providing an opportunity for graduate study at the University, the fellowship will permit the recipient to spend a summer of research work in the headquarters office of the firm in St. Louis.

Computerese Made Easy

Aware of the baffling technical jargon surrounding "electronic brains," Minneapolis-Honeywell Regulator Company has published a pocketsize 22-page glossary intended to make computer language more intelligible to the layman. The booklet, called "Do You Talk 'Computerese?'," and compiled by E. A. Murphy Jr., staff editor of the company's Instrumentation magazine, defines some 82 terms which the instrument producer's own engineers have helped to create in building industrial process computers. Honeywell expects the glossary to rival its popular "Automation Dictionary" of five years ago. That booklet, still in demand, took the secrecy out of "engineeringese" - the language by which the engineering profession talks to itself and made such items at sinusoidal, hysteresis, feedback, and optimalization more understandable.

Don't Ask For Trouble

More and more consulting engineers find the protection afforded by professional liability insurance to be the first thing they think about after the rent is paid. Without such protection, one error in arithmetic could wipe out a prac-





markers, radar and the like, to keep his ship in the safe, Motorized Valve Operators to keep your vital valves operating day and night, at just the right speed, and with no possibility of damage to the valve operating parts or the men who control the valves-by the "mere push of a button" from remote, inaccesible or hazardous locations. In addition to these desirable features, LimiTorque controls actually save considerable time, labor and money

that they can be field-mounted on existing valves with,

Refineries, Chemical Plants, Oil and Gas Pipe Lines, Steel Mills, Paper and Pulp Mills, and on ships

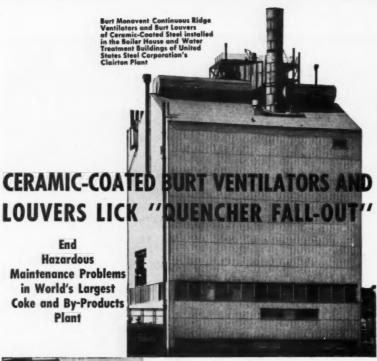
You take no chances with LimiTorque Motorized Operators, because they are not only practically infallible in operation, but they are backed by over 28 years experience, plus the facilities and reputation of one of the World's Largest Gear and Geared Products Manufacturers Consult your valve manufacturer or nearest LimiTorque Sales-Engineering Office for further details and advice.

HERE IS NO SUBSTITUTE FOR LIMITORQUE PHILADELPHIA GEAR CORPORATION KING OF PRUSSIA (SUBURBAN PHILADELPHIA), PA.

KING OF PRUSSIA (SUBURBAN PHILADELPHIA), PA.

Offices in all Principal Cities

INDUSTRIAL GEARS & SPEED REDUCERS . LIMITORQUE VALVE CONTROLS . FLUID AGITATORS . FLEXIBLE COUPLINGS Limitorque Corporation . King of Prussia, Penna.





Two runs totaling 75' of 96"
Burt Continuous Monovent are installed on the Boller House. 101
of 48" Burt Continuous Monovent Ventilators serve the Water Treatment Plant in this photo.



4,268 sq. ft. of Burt Adjustable Louvers and 635 sq. ft. of Burt Fixed Louvers are in the installation. Illustrated is a 16' x 24' Fixed Louver in the transformer Room Wall. Coke areas have probably the greatest roof and ventilator replacement in steel mills. At the United States Steel Corporation's Clairton Works, the Boiler House and Water Treatment Plant, because of prevailing winds, are subjected almost constantly to quencher fall-out.

Tests show that V-Corr ceramic-coated sheets are fully resistant to emission acids, rust and salt. The Burt ventilators and louvers, of ceramic-coated steel and stainless steel, assure long, trouble-free operation under probably the most highly corrosive conditions in the country.

There is a particular type and size of Burt Ventilator and Burt Louver to solve your ventilating problems too. Send for the Burt Data Book now for your present or future needs.



Send for FREE Data Book!

Write for Burt Data Book SPV-101-1-60 It supplies quick data on Burt's complete line of modern Roof Ventilators.

FAN & GRAVITY VENTILATORS · LOUVERS · SHEET METAL SPECIALTIES

The Burt Manufacturing Company

919 S. High Street Akron 11, Chio
MEMBER AIR MOVING & CONDITIONING ASSOCIATION, INC.

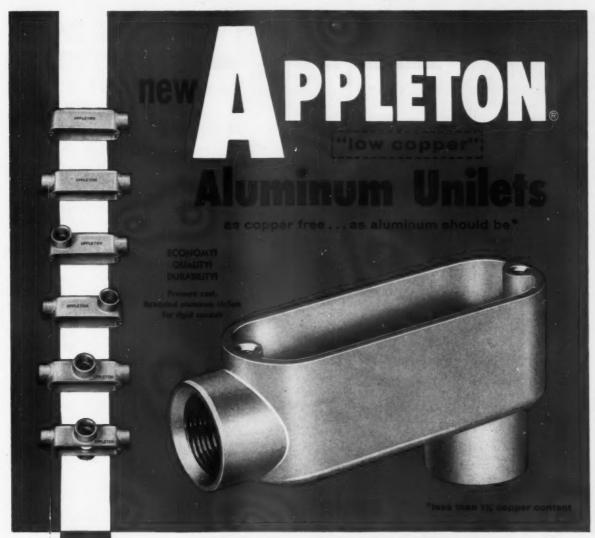
tice built upon years of conscientious and diligent service.

Unfortunately, when people start thinking about insurance companies, they become strangely calculating: "I wouldn't sue good old Joe, but it really will not hurt him any." To prevent this type of thinking from influencing juries, courts generally hold it to be grounds for a mistrial if it is even mentioned that the defendant is protected by insurance. It is not that jurists actually intend to be influenced, "but after all, it is really the insurance company who will pay, and they can afford it."

Because of this, the Task Force on Professional Liability Insurance of the NSPE Functional Section has recommended that in effect, it should not concern a client whether you, as a consulting engineer, have professional liability insurance. "Professional liability insurance should not be discussed with any prospective client, and further ... the consulting engineer should refrain from using professional liability insurance which he might carry, as a means to secure an engineering contract for engineering services. The matter should not be mentioned unless the prospective client definitely asks the question of the consulting engineer. The question should then be answered by stating that such insurance is for his own protection regarding any suits which might be brought against him concerning work executed by him." Professional liability insurance never made anyone a better engineer, and negotiations with a client should be based upon professional competence, not professional insurance.

Austin in Australia

The Austin Company will provide complete engineering and construction service to American and Canadian firms planning construction in Australia under an agreement just concluded with A. J. Anderson (N.S.W.) Pty, Ltd., of North Sydney, Australia. The Anderson or-



Form 85 Unilets

The advantages of aluminum combined with Appleton manufacturing standards for dependable performance now make available a wide selection of rugged, serviceable pressure cast aluminum fittings to give you easier electrical installations . . . faster, more economical!

Your distributor has them now. The complete line includes seven of the most popular types in 1/2", 3/4" and 1" sizes to meet most job requirements. When you use them, you will agree . . . they are outstanding in every respect-from design to manufacturing excellence.

BEFORE YOU BUY OR SPECIFY ... CHECK THESE APPLETON QUALITY FEATURES

Easy to use-roomy • Lightweight-durable • Taper Tapped threading . Precision hub alignment . Chamfered hub edges . Pressure cast smoothness • Reinforced points of stress • Easy-to-read cast identification • Attractive, practical design • Low cost-high quality . Wide assortment of covers available.

Contact your distributor or write for bulletin No. AL 60. It includes details for the entire aluminum product line by Appleton: Form 85 and larger sizes in Form 35 Unilets, FS and JB fittings and V-51 lighting fixtures.

Sold through franchised distributors only









1701 Wellington Avenue, Chicago 13, Illinois



ganization, which like Austin has its own structural steel fabricating affiliate and offers complete design and building services, has branches in Melbourne and Victoria.

Supplement to ASTM Standards

This 1960 Supplement to the 1958 Compilation of "ASTM Standards in Building Codes" calls attention to the revised standards and the new and revised tentatives, in the construction field, that have been accepted by ASTM since the appearance of the 1958 edition.

For the 73 standards and tentatives where the revisions were not extensive, complete descriptions of the revisions are given on pages 1 to 47. The revisions are so listed that the changes in individual standards can be cut from the Supplement and pasted on the standard which appears in the original book. In the case of the 27 standards and tentatives in which the revisions were rather extensive, the completely revised methods and specifications have been included in this Supplement. Also included are a total of 13 new specifications covering materials used in building constructions.

Copies of this book may be obtained from ASTM headquarters, 1916 Race Street, Philadelphia, Pennsylvania, at \$3.25 each.

1960 ARBA Directory

More than 2000 names, titles, and addresses of administrative engineers and officials in the 50 state highway departments, the District of Columbia, and Puerto Rico are listed in the 1960 edition of the convenient, pocket-size directory, "Highway Officials and Engineers," published by the American Road Builders' Association. The directory also lists administrative personnel of the Bureau of Public Roads, including the heads of its regional offices and the division offices in each state; engineers and administrative personnel of toll road authorities; and officers and directors of ARBA, its eight organized diviFor engineering, for research, for business data processing in companies both large and small... The new, fully-transistorized

RPC-4000

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Advanced design: fully transistorized-with important new computer design concepts that provide the largest memory, greatest problem-solving capacity and flexibility in the low- or medium-priced field. Entire system -computer, input-output typewriter and tape punchread console-have been specially designed as a unit. High-speed computing ability: extra large capacity (8008 words) magnetic drum memory, with special fast access features. Computing speeds of up to 230,000 operations per minute. Ultra high speed input-output: 500 characters per second photoelectric punched paper tape reader, and 300 characters per second paper tape punch available as optional equipment. Easy to use: maximum results can be obtained by non-technical personnel. Users benefit from free training, continuing assistance, an extensive library of programs. Versatile command structure provides programming speed and flexibility. Low in cost: priced just above the small-scale computers, the RPC-4000 outperforms computers costing many times more. Economical to install and

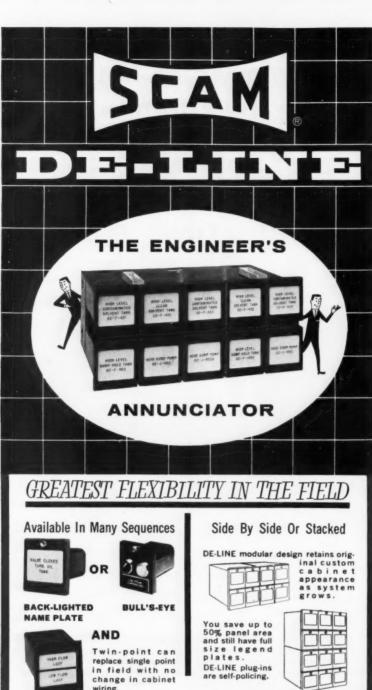
operate: no site preparation, air-conditioning or special maintenance required. Plugs into any standard wall outlet. Multiple application ability: designed to perform engineering, scientific and research calculations, as well as business data processing and management control functions.

The RPC-4000 is a product of the Royal Precision Corporation, and is marketed by the Data Processing Division of Royal McBee. It is the latest member of the growing family of electronic computers from the people whose LGP-30 has become the world's leading small-scale computer.



Royal Precision Corporation

Royal Precision is jointly owned by the Royal McBee and General Precision Equipment Corporations. RPC-4000 sales and service are available coast-to-coast, in Canada and abroad through Royal McBee Data Processing offices. For full specifications, write ROYAL McBEE CORPORATION, data processing division, Port Chester, N.Y.





AUXILIARY CONTACTS N.O.-N.C. standard with most plug-ins.

SAME PLUG-IN operates from N.O. or N.C. trouble contacts.



SEQUENCE OPTION after installation by means of independent slide switch at each point.

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sions, and its Washington headquarters staff. As in previous years, the directory may be obtained for \$1 per copy from American Road Builders' Association, World Center Building, Washington 6, D. C.

Golden Gate Rebuilding

Rebuilding the bracing on San Francisco's Golden Gate Bridge to carry two commuter railroad tracks would cost \$8.7 million, according to D. B. Steinman, New York consulting engineer. The Bay Area Rapid Transit District said the tracks themselves, necessary signals, and an electrical supply system would amount to several million dollars more.

In a detailed report supporting conclusions reported to the district in March, Steinman said wind tunnel tests confirming his studies would be submitted later to the directors. He said the tracks would not change the appearance of the bridge. They would be centered under a roadway and rest on braces that have been in place ever since the bridge was completed. Construction would not even entail suspension of traffic on the bridge's six lanes. Materials could be moved along the sidewalks, instead of the roadway.

The directors agreed to approve final plans for the five-county system in time to submit them to boards of supervisors for study this fall. Approval of the boards will be required before a bond issue for the \$900 million system can be placed on the ballot in 1961.

On the Industrial Front

One out of four engineers in industry believes that engineers are thought of as second class professionals, but no industrial managers agree with this opinion.

Sixty-one percent of the engineers employed in industry think there is considerable mal-utilization of engineers, but only 30 percent of industrial managers agree.

More than half the engineers in industry think that higher pay

FOR Inherent AccuracyPower-Speed and Stability

FISHER TYPE 470 P.O.P.

- Delivers same power in either direction at any point of the stroke.
- Adaptable to virtually all types of valve bodies including Butterfly valves.
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This small, compact piston actuator incorporates its own positioner mounted integrally on top of the cylinder. Positioner receives any of the normally used pneumatic instrument signals. Then, without an air set, actuator utilizes the full potential of the available instrument or gas supply to provide exceptional speed and power. Series 470 is available in six basic sizes and can be supplied for travel up to 4". Basic actuator can also be furnished with a handjack, hydraulic snubber, pneumatic safety devices or as a spring return unit. Write for Bulletin E-470.

PERFORMANCE DATA

Air Consumption (Static) 20 SCFH at 100 psi supply.

Instrument Signals.......3 to 15 psi, 5 to 25 psi, 6 to 30 psi, 12 to 60 psi. Suitable for split range

Temperature Limitation.....175°F.

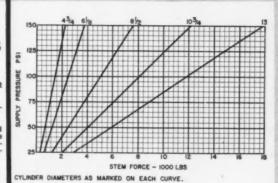
Maximum Hysteresis.........0.15% of total stroke or instrument signal.

Resolution Sensitivity.......Minimum change in the measured variable to produce an effective movement of the final control element is .02% of the instrument pres-

Frequency Response...... 1.4 cps for the Size 60.

Load Sensitivity...... Percent of total travel per 100 lbs. stem force is .065% for Size 60.





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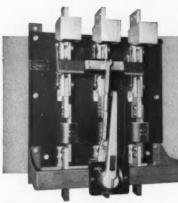


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A New Load Break Service Entrance Switch

BOLT-LOC*by BARKELEWY

FOR 1200 • 1600 • 2000 AMPERES • 240 • 480 • 600 VOLTS

Designed primarily for use with high interrupting capacity fuses for service entrance applications, and with or without fuses, as isolating switches, feeder disconnect or protector switches, for controlling electrochemical processes or any other use where cool operation, rugged construction, safety and complete reliability are required. Thoroughly tested for interrupting, short circuit and load carrying capacity.



Molded arc suppressing material houses double slot multiple steel plate arc

Vertical terminal contacts for easy bus and cable connections.

Using adapters, bus bars can be mounted parallel to base.

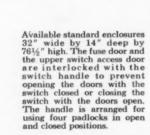
Positively locked forged nut for adjusting contact pressure, pre-set and locked at factory. Stainless steel spring holds initial contact pressure.

Handle contains latch for holding switch open or closed and slot for four padlocks.

Large bronze sleeve bearing supports operating shaft. Close tolerances throughout the switch mechanism give positive operation and long life.

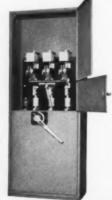
Formed frame supports operating mechanism. No additional supports needed. Switch is adjusted before shipment, ready for mounting.

Quick break mechanism opens switch rapidly, drawing arc thru quenchers where it is quickly extinguished, usually in less than 1½ cycles.



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would advance the engineering profession, but only 20 percent of industrial managers agree.

These are some of the findings reported in a survey entitled "Engineering Professionalism in Industry," made under the sponsorship of the Professional Engineers Conference Board for Industry, in cooperation with the National Society of Professional Engineers. The primary objective of the study was to find out what engineers and engineering managers mean by professionalism, and how they think it can best be advanced.

Certifying Technicians

Establishment of an Institute for the Certification of Engineering Technicians and Engineering Technologists has been approved by the board of directors of the National Society of Professional Engineers. The National Society will organize and operate the Institute to determine by examination, endorsement, or otherwise, the qualifications of all persons who apply for certification; and grant a certificate in the appropriate grade to applicants who successfully meet the criteria for certification.

The Institute, which is to be exclusively an examining body, will be operated by a board of directors comprising equal numbers of registered professional engineers and certified engineering technologists.

CEC Manual

"The Practice of Consulting Engineering," published by the Consulting Engineers Council, assembles in one volume a series of practical guides to the mechanics and performance necessary in conducting a successful consulting engineering practice. It also is designed for use by engineering students, manufacturers, and clients. The manual covers 95 specific aspects of practice in its 200 pages.

"This manual will serve as a reference for engineers expecting to enter private practice, engineering and management departments



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Dialed "C" for
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This exposed view shows a Kno-Draft circular diffuser tied into the ductwork.

The combination air diffuser-loudspeaker offers functional and design advantages... both the sound source and the diffuser occupy the same strategic celling location.



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...in their handsome new office building, Charleston, West Virginia

> Type KP (overlap) diffusers complement essentially recti-linear pattern of certain areas.

Commonly these days, business and industry call on leaders like Connor to provide new or remodeled buildings with modern interior atmospheric comfort that matches the modernity of architectural design.

Here in this new 4-story office building, for example, more than 800 various Connor units have been entrusted with the 'round-the-calendar job of giving the Telephone Company's employees a comfortable climate in which to work. In addition to producing effective air distribution, the Kno-Draft squares and rounds-with their clean, simple lines-blend neatly with the building's interior ... and 230 Kno-Draft loudspeaker diffusers enable installation of both communication and comfort sources in the same strategic ceiling locations ... just one installation hole for two separate, vital functions.

Seeking proper design and perfect function, architect, engineer, and contractor can choose confidently from the Kno-Draft line . . . can be sure that his choice will have the others' approval and will delight the client. Write for complete information.

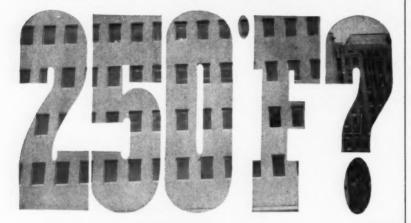
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These forced recirculation water tube Generators extract more heat from less water. By merely increasing the temperature differential between boiler outlet and return water from the "conventional" 20°F. to 80°F., water flow rates are cut 75%. Lower flow rates mean reduced pipe and pump sizes, with attendant savings throughout the system. With International-LaMont THERMOJET® Generators, temperature differentials up to 200°F. are in use and are recommended, effecting even greater savings.

Positive, high velocity boiler water circulation assures peak heat absorption rates—far beyond those obtainable with natural circulation boilers, plus instant response to changing load demands. Any danger of thermal shock is eliminated.

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of industry, government, and schools and colleges, and will further acquaint engineers, their clientele, and the associated trades and professions with the principles and practices of the consulting engineer," said Thomas R. Miles, editor and chairman of the Manual of Practice committee. Miles, a consulting engineer in Beaverton, Oregon, is immediate past second vice president of CEC. Other members of the committee are Lloyd Clark of Clark & Groff Engineers, Salem, Oregon; Holly Cornell, civil and mechanical engineer, Corvallis, Oregon; Donald Kroeker of J. Donald Kroeker & Associates, Portland; Harry Czyzewski of Metallurgical Engineers, Inc., Portland, newlyelected president of the Consulting Engineers of Oregon; and Joe Williamson, Jr., of St. Louis.

Automated Contour Mapping

Contour mapping can now be almost completely mechanized, according to Ford Bartlett, president of Lockwood, Kessler & Bartlett, consulting engineer firm of Syosset, Long Island. A digitizer, specially built for the firm by AIL Division of Cutler-Hammer, Inc., Mineola, not only saves time and man-hours of skilled work, but reduces the need for mapping in some special fields. Lockwood, Kessler & Bartlett underwrote about a third of the estimated \$45,000 of development costs that went into the new machine.

The equipment works from aerial photographs, in conjunction with a Wild Stereoplotter, recording coordinates from the photos on paper, in light signals, and on punched paper tape. It requires one operator, instead of the three formerly needed. In addition, the punched tape eliminates further work in preparing data that can be used in a computer to process the results required. Terrain data processed in this way is a lowcost substitute for weeks or months of field survey by ground engineering crews.



select the STRUME strainer designed for you!

IN steam, air, gas, water, oil or chemical systems, a correctly selected strainer pays for itself many times. It protects expensive equipment (traps, control instruments, meters, etc.) and reduces over-all maintenance and service costs.

Assure your system maximum protection from dirt, scale, sludge and sediment . . . specify the STRONG strainer designed for your requirements.

Sizes: from 1/4" to 8"

Service: 250 psi at 450° F to 2500 psi at 1100° F

Screens: stainless screens with .027", .045", .062", or .125" perforations (at no extra cost)

Types: "Y" or Angle with screwed or socket-weld (flanged) connections

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STRONG'S extensive line of rugged, high-quality strainers are available from your local STRONG distributor. Contact him for assistance in selecting the *right* strainer, or write for your copy of STRONG Bulletin SS—21C.



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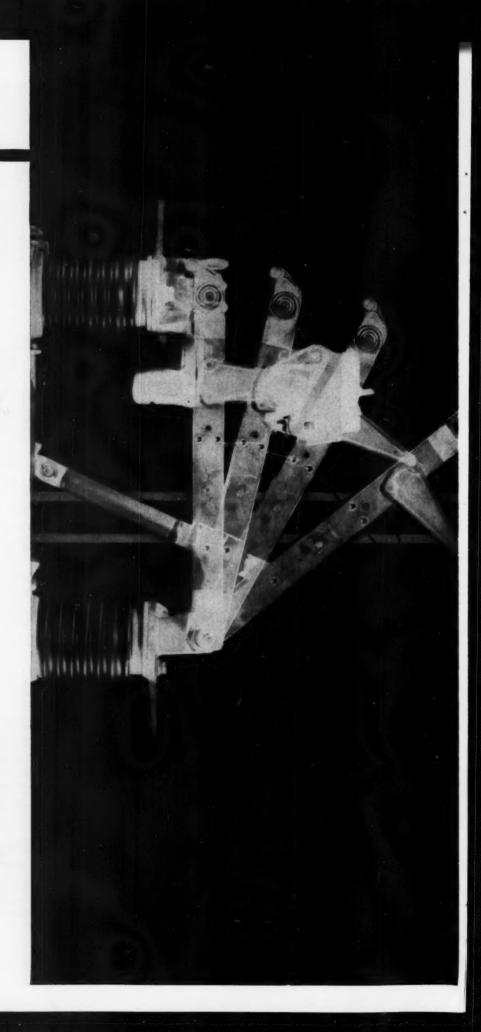
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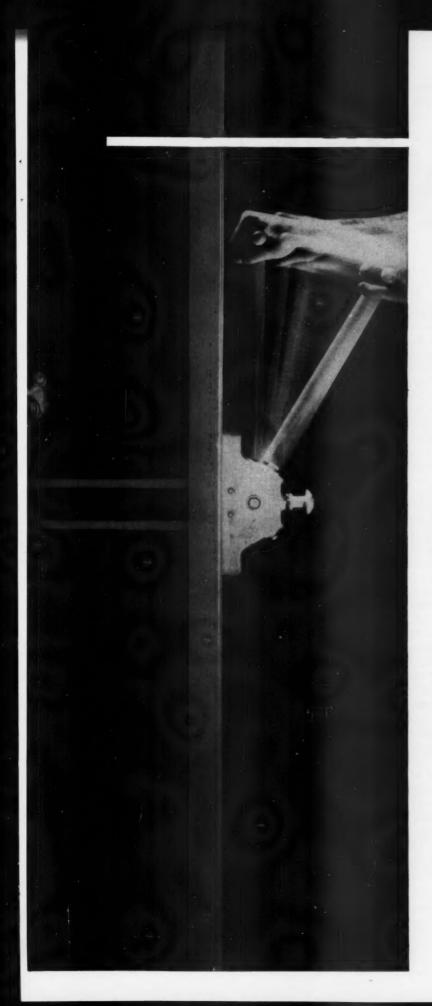
air traps • strainers • reducing valves • vacuum or pumping traps continuous blowdown valves • separators • engine stops • F and T traps •safety headgear

FAULT - CLOSING



S&C metalciad switchgear meets all requirements of new National Electric Code for fault closing, short-circuit interruption. Performance proved by high power testing at KEMA laboratories.





S&C metalclad switchgear can close on any fault up to 60,000 amps

No danger to equipment—no danger to operator even if he closes load interrupter switch on the heaviest faults. S&C's new line of metalclad switchgear is rated as high as 40,000 amps fault closing, 500 mva short-circuit interrupting at 14.4 kv. And at 4.16 kv, the corresponding ratings are 60,000 amps, 250 mva!

Here's how it works: 1) Fault never flows through interrupting unit when switch is closed . . . it flows through separate arcing contacts; 2) Arcing is minimized and magnetic forces are overcome by quick-make, quick-break toggle action no matter how slowly operator closes handle.

Short-circuit interrupting duty (up to 500 mva) is handled by a new boric acid power fuse, the Type SM, which features multiple bore construction to handle low, medium, and high faults.

The simplicity of the S&C design—power fuses for short-circuit interruption and load interrupters for manual or automatic load switching—enables you to save as much as 50 percent on your switchgear investment. Why not consider S&C Metalclad Switchgear for your high voltage power systems? In industrial plants and commercial and institutional buildings there are rarely any transient faults, so there is no real need for the automatic reclosing ability of the more expensive circuit breaker type of switchgear.

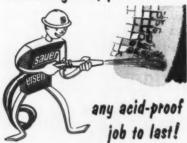
For more information please consult the telephone directory for your nearest S&C sales office.

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Yes, Sauereisen Pour-Lay Cement No. 54, the Acid-Proof Concrete, is ready to go to work for you, too . . . for floors, tanks, chimneys. Provides resistance to all corrosive acids (except hydrofluoric) and temperatures as high as 2000°F. Can be gunited, poured, cast in forms or applied as a topping over concrete, brick or tile.

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Steel For A Perfect Purpose

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Self-contained T-tops fit channels, are retained from end-to-end. Plan holders "glide" easily in or out.

As needs enlarge, add channels and plan holders. Same-size, attachable extensions are available. For faster reference, extra speed and system, here is the lowest priced vertical plans file.

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Men in Engineering

Charles R. Wilson, engineer, Goodkind and O'Dea, consulting engineers of Bloomfield, New Jersey and Robert L. Schiffman, assistant professor of Soil Mechanics, Rensselaer Polytechnic Institute, were presented with the C. A. Hogentogler Award at the Session on Soils for Engineering Purposes at the 63rd Annual Meeting of the American Society for Testing Materials held at Atlantic City, New Jersey. The two received the award for their joint paper on "The Mechanical Behavior of Chemically Treated Granular Soils."

The new board of directors of the Consulting Engineers Association of Washington is as follows: M. B. Cook, chairman, Tracy, Cook, Branstrom and Dudley: Charles R. Lyon, secretary, Ruskin Fisher and Associates: Norman A. Carson, treasurer, R. W. Beck and Associates; Joe Lamont, Dames and Moore; Harrison W. Kramer, Carey and Kramer; Allen F. Hill, Hill and Ingman; Peter H. Hostmark, Peter H. Hostmark and Associates; and Horace J. Whittaker, Horace J. Whittaker and Associates. All are from Seattle except Horace J. Whittaker, who is from Tacoma.

The CEAW "Engineer of the Year" award was presented to Ralph M. Westcott, president of Holladay and Westcott, consulting engineers of Los Angeles, California. Westcott is immediate past president of the Consulting Engineers Council. The award was based on the great personal sacrifice of time and money that have

been expended to protect the public from insidious and irresponsible water treatment gadgets along with his accomplishments on behalf of the engineering profession during the past year.

Election of two vice presidents of Stone & Webster Engineering Corporation has been announced. They are Theodore E. Casselman Jr., manager of the firm's New York



CASSELMAN

ROBERTS

office, and Wilbur S. Roberts Jr., manager of Stone & Webster's new business activities.

New address of Samborn, Steketee, Otis and Evans, Toledo engineers and architects, is Libbey-Owens-Ford Building, Toledo 2, Ohio.

Several organizational changes became effective last month at Gilbert Associates, Inc., engineers and constructors, Lancaster, Pennsylvania: Leslie D. Staver, president of the firm since 1942, has become chairman of the board and chief administrative officer; Malcolm Duncan, formerly executive vice president, has become president

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You're ahead, too, when you use the Wedgelock coupling because it is designed for faster, easier,

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For air, water and ventilating service, you can't beat the matched performance of this NAYLOR pipe and coupling combination. Write for Bulletin No. 59.



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Little effect! The normal amount of calcium chloride used in cement is 2% of the dry cement by weight. This amount won't harm either aluminum or steel buried in concrete. However, if excessive amounts are used, calcium chloride could possibly corrode steel or aluminum as well as have a harmful effect on the concrete itself.

For all the answers about aluminum rigid conduit, call any Kaiser Aluminum distributor or sales office.



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You get more pumping capacity from these new Viking heavy duty stainless steel pumps because they can be operated up to 100%, rated speed. By increasing the speed of a Viking pump its capacity is increased correspondingly. Upwards of \$300 to \$400 can be saved on some pumping applications. ■ Entirely new, modern foundry facilities and be saved on some pumping applications. ■ Entirely new, modern foundry facilities and annufacturing processes enable the complete line of Viking alloy pumps to meet more exacting requirements than ever before and at higher speeds. ■ If your specifications call for stainless steel or other alloy pumps, see how you, too, can save on the new line of full speed Viking alloy pumps.

*Also Steel, Monel, Nickel, Ni-Resial, Ductile Iron, Other Alloys

VIKING PUMP COMPANY Cedar Falls, Iowa, U.S.A. In Canada, It's "ROTO-KING" Pumps

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and chief executive officer; and James R. Stoudt, a vice president and assistant to the president, is now executive vice president.

M. Mack Earle has resigned as chief naval architect of the Maryland Shipbuilding and Drydock Company and has entered into private practice as a consulting naval architect. Earle is generally credited with the development of the jumboizing process by means of which many structurally obsolete T2 tankers have been modernized and enlarged. He also has been closely associated with conversions of ocean-going vessels for the Great Lakes. Office address is 1602 Timbercrest Drive, Baltimore, Md.





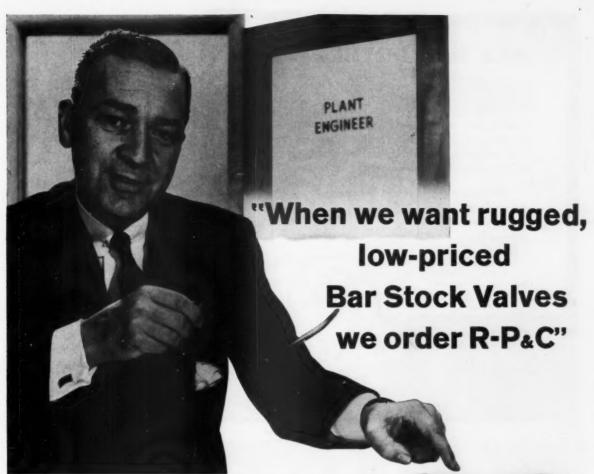
EARLE

SMITH

New assignments for three members of Stanley Engineering Company, consulting engineers, Muscatine, Iowa, have been announced by the firm. Murray Sedgley has been appointed head of the construction group; Lowell Titus has been appointed head of the civil department of the design group; and Paul Sehnert has been appointed head of the Chicago department of the design group.

The firm also revealed that H. S. Smith has withdrawn as a partner, in order to do graduate work and research at the State University of Iowa, to be followed by teaching.

The Structural Engineers Association of Oregon has elected the following officers for 1960-61: president, Lloyd A. Pajunen, Oswego; vice president, Robert R. Adams, Corvallis; secretary-treasurer, Miles



"For a really versatile, all-purpose valve, we've found there's none better than R-P&C bar stock valves. Designed and built for close control service, the construction of these valves makes them well suited to many general purpose applications as well. For example, the compactness of R-P&C bar stock valves is particularly advantageous for close-coupled installations in instrument lines or on panel boards and for pressures up to 10,000 lbs. in steel."

These valves are available in a wide variety of materials to withstand extremely high temperatures and pressures. But best of all, R-P&C bar stock valves are economically priced. This is made possible through special techniques developed by R-P&C.

We highly recommend R-P&C bar stock valves for meter, gauge, sampling, or test valves on equipment requiring a reliable compact valve that can withstand high pressure service.

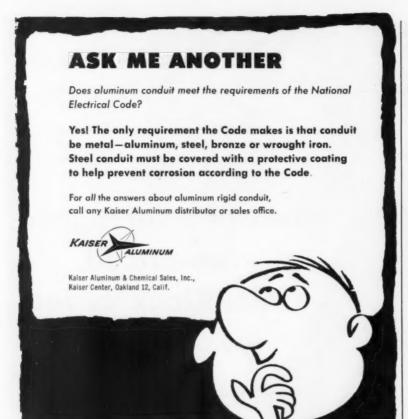
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R. Abel, Beaverton; director, 2year term, Donald R. Kramer, Vancouver; and director, 1-year term, Cyril Burgstahler, Portland. Holdover director is Irving E. Olsen, Portland.

John F. Ring, formerly with Stone & Webster Service Corporation, has joined Ebasco Services, Inc. as gas engineer in the consulting engineering department.

Joseph E. Robbins, formerly director of defense and aeronautical division of Burns and Roe, Inc., has become a partner of Pope and Evans, New York consulting engineering firm, and will manage its new defense projects division.

Ord Alexander has announced his resignation from the National Coal Association to join Johnson-Momsen Associates, consulting engineers of Arlington, Virginia.

Richard S. Bean has joined the Birmingham, Alabama office of The Rust Engineering Company as staff engineer, pulp and paper mills. Previously, Bean served 15 years with Hollingsworth and Whitney Division, Scott Paper Co.

Rod J. Gomez has been named chief engineer in the recently opened Tucson, Arizona office of the consulting engineering firm of Boduroff & Meheen. The firm also has offices in Denver, Colorado and Phoenix, Arizona.

Richard L. King, consulting engineer, has moved his office to 643% Semmes Street, Memphis, Tenn.

William L. Clark, Jr., consulting engineer, announces the removal of his offices from Waterville, Ohio to 2223 River Road, Maumee, Ohio.

A new partnership, Cottingham and Hale, has been formed for the general practice of civil and structural engineering. Principals are Worth Cottingham, formerly of





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Protects water supply, sewage and flood control operations against power failures; also permits overhauling electric motor or power unit without interrupting service. Thousands in use by municipalities,

industry and farmers. Available in turbine or engine driven combination drive (as shown here), standard and dual types, with either hollow or solid shaft. Sizes: 15 to 450 hp. Write now for engineering catalogs.

GEAR & MANUFACTURING CO., LTD.

East and Gulf Coast representatives: Smith Meeter Engineering Co., 157 Chambers St., New York City Wilson and Cottingham, consulting engineers, and Isom H. Hale, consulting engineer. Address of the new firm is 610 Scarbrough Building, Austin, Texas.

Stanley W. Connelly has been elected president of Brisch, Inc., international organization of consulting engineers specializing in industrial classification and coding. He succeeds Edward G. Brisch, founder of the firm, who died in Toledo on April 8.

Joseph Gombinski, managing director of an associate company, E. G. Brisch & Partners, Ltd., London, has been elected vice president of Brisch, Inc. Though he will continue to headquarter in London, his election as an officer of the American company points up the close tie between the two organizations and their ability to furnish integrated international services.



CONNELLY

MC DONOUGH

Jack McDonough has been named to the new position of assistant to the president of Meissner Engineers, Inc., Chicago engineering and construction management firm.

New address of Lev Zetlin, Consulting Engineer, is 114 East 32nd Street, New York, New York.

Tom A. Clark, recently retired from the staff of the International Cooperation Administration's operations mission in Ceylon, has arrived in Denver, Colorado, to join the professional staff of Engineering Consultants, Inc. After briefing at the ECI Denver office, he will leave for Dacca, East Pakistan, as



Right angle

GEAR DRIVES



The ultimate in convenience and safety for modern pedestrian travel



Typical of SPEEDRAMP Passenger Conveyors for inclined travel is the installation above at the Gay Stree? Promenade, Knoxville, Tennessee. Pedestrian traffic moves from parking plaza to promenade area via SPEEDRAMP Conveyor.

SPEEDWALK.&SPEEDRAMP

(HORIZONTAL TRAVEL)

(INCLINED TRAVEL)

PASSENGER CONVEYOR SYSTEMS

At Freedomland, a giant new amusement center in the Bronx, New York, twin SPEEDWALK Passenger Conveyors span the "golden lake" to Satellite City. Visitors are carried to and from the futuristic city via the SPEEDWALK Conveyor with the ultimate in convenience and safety in modern pedestrian travel.

Installations from coast to coast and around the world handle millions of passengers with enviable performance records unmatched by other types of passenger conveyances.

Although SPEEDWALK and SPEEDRAMP Conveyors afford a 20% to 30% savings in initial cost, the real benefits come with time. Advantages of showcase beauty, passenger safety, simplified maintenance and public relations building passenger convenience pay dividends for years to come.

Find out for yourself why SPEEDWALK and SPEEDRAMP Passenger Conveyors are becoming increasingly popular and are more and more evident on the pedestrian transportation scene. Write for details today!



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Secluded enchantment

Biessed privacy is gained, worries left at the foot of the mountain. This is the shangri-la, the escape, the wilderness of breathtaking beauty and mountain grandeur, where the only sounds you hear are forest sounds, bird sounds, the wind and water and mountains. Vacation this year at, escape this year to

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Swimming
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Mountain Climbing
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Write for folder, Mountain Lake, Va. Open May 23-Oct. 1.
American Plan. Reasonable rates. Secluded cottages, hotel accommedations.

general manager of ECI, International on a project to determine feasibility of the proposed \$200 million Brahmaputra project in Pakistan.

A new firm, Moote & Kempa Engineering Company, has been formed, with principal offices in Phoenix, Arizona, for the practice of consulting civil engineering. Principals are Volney N. Moote and Roma G. Foley. Directors are Volney N. Moote, Paul A. Moote, Richard G. Kempa, and Robert H. Kempa.

Bernard Johnson & Associates, consulting engineers, Houston, Texas, announce the admission of Paul C. Nail and E. Jerry Dietrich to the firm as stockholder-partners. The two new partners have been elected vice presidents with Nail in charge of mechanical and electrical engi-





NAIL

DIETRICH

neering and Dietrich in charge of civil and structural engineering.

A new partnership, Benjamin & Flack, has been formed for the practice of consulting engineering. Principals are Arthur D. Benjamin and Peter Flack. Address of the new firm is 37 West 39th Street, New York, New York.

P. R. Paulick, consulting mining engineer of Bethel Park, Pennsylvania, has been invited to present a paper on American mining methods before the Hungarian Mining & Metallurgical Society mining congress to be held in Budapest this month. Paulick will be one of

3,000 SPEAKERS BARK

with the flick of a switch at the U.S. Air Force Academy

One of the world's largest sound communication installations engineered by Skidmore, Owings and Merrill.

3,000 Stromberg-Carlson speakers, located throughout the extensive complex of buildings and outdoor areas at the U.S. Air Force Academy can be used for emergency or general announcements, background music and audible time signals operated from a master clock.

In addition, this flexible Stromberg-Carlson installation allows for the independent operation of "Satellite Systems" in various, widely separated areas, services a number of restricted locations including outdoor recreation areas with weatherproof loudspeakers and amplifiers . . . and features a series of call-in stations for two-way communications.

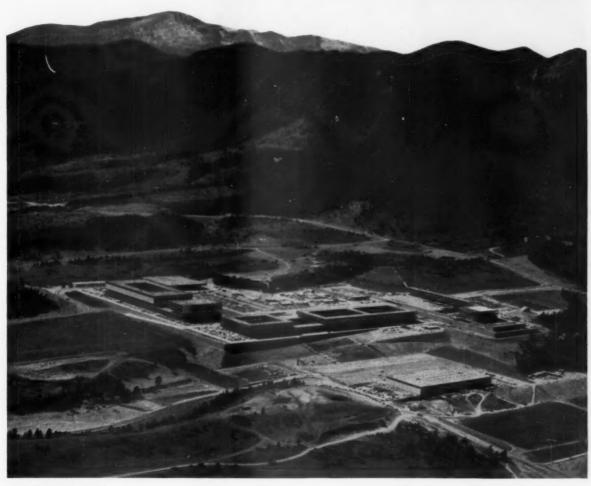
Skidmore. Owings and Merrill were able to effect con-

siderable economies in installation and initial equipment costs by using quality-engineered standard Stromberg-Carlson components throughout. And, at all times, from the earliest planning stages to completion of the installation, Stromberg-Carlson's expert Consulting Service was available.

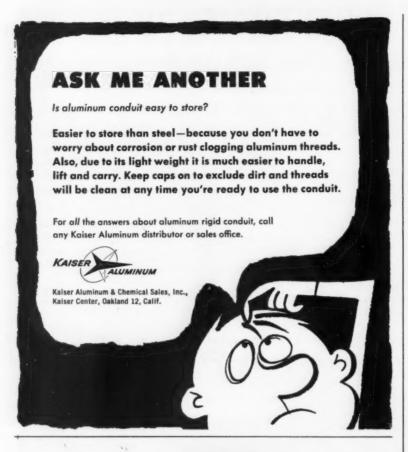
You, too, will find this service advantageous. No matter where you are located, only a local phone call away there is a Stromberg-Carlson communications consultant. Write now for full information and a copy of Stromberg-Carlson's Sound Engineers Manual—the industry's most complete sound engineering reference book. Write to:

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SEPTEMBER 1960





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few American visitors at the convention and will be the only American speaker on the program.

New address of Wheeler and Wright, consulting hydrological engineers, Denver, Colorado, is 2133 South Bellaire Street.

A. Henry Schutte, formerly vice president of the Lummus Company, has joined the senior staff of the chemical engineering section of Arthur D. Little, Inc.

Albert T. Peagan, railroad executive who served 30 years on major roads, has joined the staff of Ford, Bacon & Davis, Inc., New York consulting engineering firm. Peagan has extensive experience in railroad administration, research, engineering, and construction.

New address of Scandale Associates, consulting civil engineers, is 136 Market Street, Moscow, Pa.

N. G. Dracos Associates, engineers, announce the opening of an office for structural and soil engineering at 72 S.E. Second Street, Orchid Square, Boca Raton, Florida.

Fred W. McCloska, partner in charge of the Nuclear Department, Sargent & Lundy Engineers, Chicago, has been elevated to the grade of Fellow by the American Institute of Electrical Engineers, "For contributions to design and application of electric equipment to power systems industrial and nuclear plants."

Lawrence E. Hurd and Michael Stuart have been assigned to the Guam office of Thomas J. Davis, Inc., affiliate of Engineering Service Corporation, of Los Angeles.

Woodward-Clyde-Sherard & Associates, soil and foundation consulting engineers, Kansas City, Missouri, announce the appointments of Nicholas Chryssafopoulos as resident manager in charge of the

WANT TO SAVE SOME MONEY?





I-T-E URELITE individually enclosed large air circuit breakers. Available up to $600\,\mathrm{v}$ a-c, $15\text{--}4000\,\mathrm{amp}$ continuous, up to $150,000\,\mathrm{amp}$ interrupting.

SAVE INSTALLATION EXPENSE

Look at that roomy cable box. I-T-E URELITE $_{\circledast}$ gives plenty of elbow room to the men who install it. Easy to pull and connect even extra-large conductors. You can bring them in from either the top or bottom. This design means fast, easy, low-cost installation.



SAVE MONEY WHEN YOUR LOAD GROWS

Want to increase the current rating of your URELITE breaker? Just reset the trip devices. It takes only minutes. Expanded ranges eliminate shutting down the circuit and replacing devices. Calibration is directly in amperes for easy, accurate setting.

Send for new illustrated Bulletin 4261-2b. I-T-E Circuit Breaker Company, Dept. SW., 1900 Hamilton St., Philadelphia 30, Pa.



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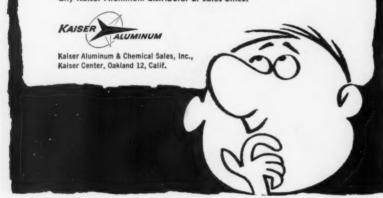


How does aluminum compare with steel on a strength basis; and is conduit ever figured as a component of concrete strength as reinforcing in concrete columns or slabs?

Steel has 51,000 psi ultimate strength and 20% elongation.

Aluminum has about 22,000 psi and 20% elongation—
more than enough strength to dependably protect
enclosed conductors. Conduit is definitely not figured
as a component of strength in concrete reinforcing.

For all the answers about aluminum rigid conduit, call any Kaiser Aluminum distributor or sales office.



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Clean machines hold close tolerances better and up to 80% longer. Result: a measurable saving in both the cost and frequency of servicing and maintenance work. You can protect your client's plant and equipment investment, help reduce potential production breakdowns, by specifying TORIT Dust Collectors. In the cabinet type (illustrated by cutaway drawing) filters are rated 99.99% efficient by weight on particles as small as $\frac{1}{2}$ micron! Compact Torit high efficiency cyclone and cabinet type units are designed to save space, install anywhere. Your Torit representative will gladly give you dust collector specifications, performance charts, dimensional drawings and installation suggestions. Write:

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firm's Kansas City and St. Louis offices, and of Donald M. Duncan as chief engineer.

Earl C. Reynolds, Jr. has been named a partner of Cornell, Howland, Hayes & Merryfield, consulting engineers, with offices in Corvallis, Oregon and Boise, Idaho. Reynolds has managed the Boise office of the firm since it opened in 1950. Other partners in the firm are Holly A. Cornell, James C. Howland, Thomas B. Hayes, Fred Merryfield, Archie H. Rice, and Ralph E. Roderick.

Announcement also has been made of the establishment of an office in the Logan Building, Seat-





REYNOLDS

LADEN AIR

CORNELL

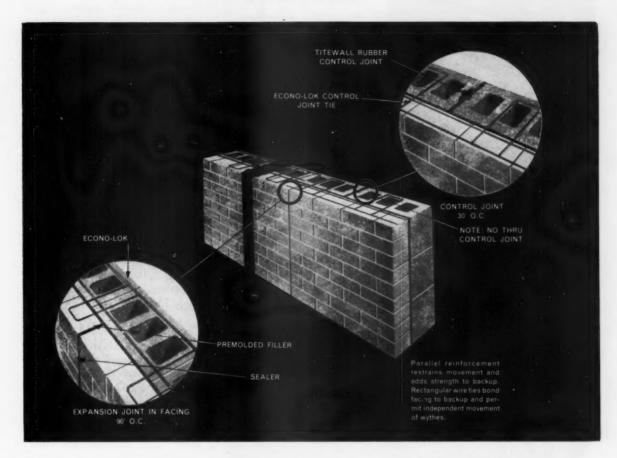
tle, Washington. Resident partner for the new office is Holly A. Cornell, one of the four original partners when the firm was founded in 1946. Assisting Cornell is James W. Poirot who has served as a project engineer with the firm since 1955.

W. B. Thompson has been named vice president of J. T. Donald & Co. Limited, Montreal consulting chemical engineers and chemists.

New address of Stacy & Skinner, consulting engineers is 10,000 Santa Monica Boulevard, Los Angeles 25, California.

Announcement has been made of the retirement of Ken Murray, of K. J. Murray & Associates, consulting engineers, of Denver, Colorado. Management of the firm has been turned over to Olof Lindquist and

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Exposed sides and interior sides of faced masonry walls are subject to differing stresses under varying atmospheric conditions.

These stresses continue throughout the life of the building and will—if not relieved—eventually cause fatigue failure.

These normal stresses can be virtually eliminated through the use of ECONO-LOK®* reinforcing ties and the proper spacing of control or expansion joints. WRITE FOR NEW TECHNICAL CATALOG.

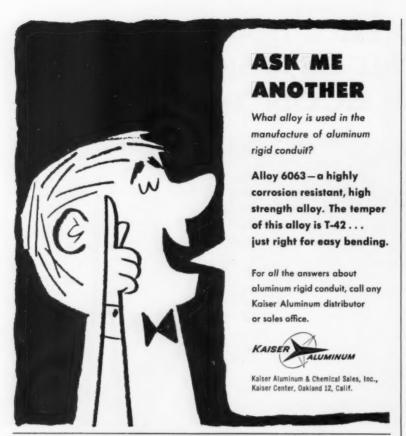


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Jim Griffith, who are operating as a partnership under the name of K. J. Murray & Associates.

Ernest R. Gerlach has been appointed chief engineer of the Los Angeles Metropolitan Transit Authority. Gerlach's primary responsibility will be to advise and counsel the Authority on mass rapid transit. He also will be in charge of all planning and of completing the integration into one consolidated operation of the bus, street car, and train lines the MTA purchased from three private companies in March 1958. Gerlach has worked on MTA affairs since 1954 as an engineer with Coverdale & Colpitts, New York consulting engineers with whom the MTA has had several study and consulting contracts. Since March 1958, when the MTA began operations, Gerlach has been with the MTA as resident representative for Coverdale & Colpitts. He is resigning this position to take the new post on MTA's staff.

Engineers Incorporated, engineers and designers of Newark, New Jersey, has opened a branch office in Washington, D. C. Rear Admiral P. H. FitzGerald, USN (ret) has been named general manager.

To define more adequately the scope of its activities, the Heavy Construction Division of Henry J. Kaiser Company has been renamed Kaiser Engineers International, division of Henry J. Kaiser Company. Announcement also has been made of the appointment of John Hallett, a vice president of Henry J. Kaiser Company and formerly assistant general manager, as general manager of the newly named division. Hallett will be responsible for all engineering and construction activities outside of the United States and Canada. L. H. Oppenheim, vice president and general manager of Kaiser Engineers, will continue to be responsible for the firm's industrial engineering and

NEW SUTORBILT SERIES 3200 BLOWERS AND GAS PUMPS

with one-piece shafts for greater efficiency at increased horsepower and pressure ratings



New Series 3200 Sutorbilt lobe-type rotary positive blowers and gas pumps feature *one-piece* shafts. Forged from a single billet of 4140 alloy steel, they are slip fitted through—and bolted to—the impellers at the gear end.

Why a One-Piece Shaff? These heavy duty, high performance units must operate safely from 800 to 20,000 cfm at pressures from 2 to 10 psi. Incorporating this advanced shaft design in all 42 sizes eliminates using the drive impeller to transmit power . . . and greatly reduces the torsional deflection of the shaft between the timing gears and the impellers. And this one-piece shaft also eliminates adding outboard bearings for V-belt drive with normal working loads.

Other Outstanding Features include oversize heavy duty, anti-friction roller bearings with lip-type oil seals, machined sub-bases, alloy steel precision machined helical timing gears piloted to the shafts for concentricity, close grain cast iron impellers and a reversible oil pump with an oversize sump that eliminates the need for an oil cooler at ambient temperatures below 125°F. In gas and high vacuum pumps, mechanical seals prevent leakage or gas contamination.

For more information and detailed specifications on these powerful, peakperformance units, write today. Department B.

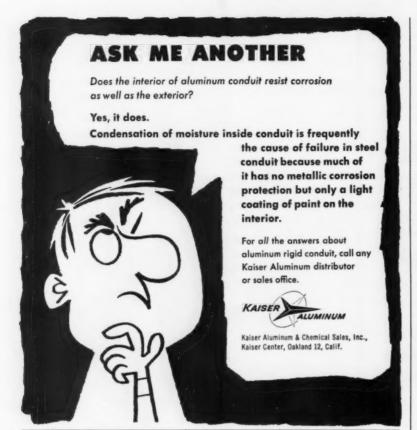
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Since 1941, TAPECOAT has proved its superiority in resisting moisture, acids, alkalis, and other severe corrosive and abrasive conditions. TAPECOAT comes in rolls of 2", 3", 4", 6", 18" and 24" widths. It is easy to apply with the use of a torch to bleed the coating which serves as both bond and protection. No skilled help required.

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construction activities in the U.S. and Canada and, in addition, will have the responsibility for all heavy construction projects in these areas.

Dames & Moore, consulting engineers of Los Angeles, has announced the opening of an office in Honolulu. David C. Liu, with Dames & Moore since 1950, has been named associate in charge of the new office, located at 184 South Hotel Street, Honolulu 13, Hawaii. The opening of the Honolulu office brings to ten the total number of the firm's offices in the U.S.





LIU

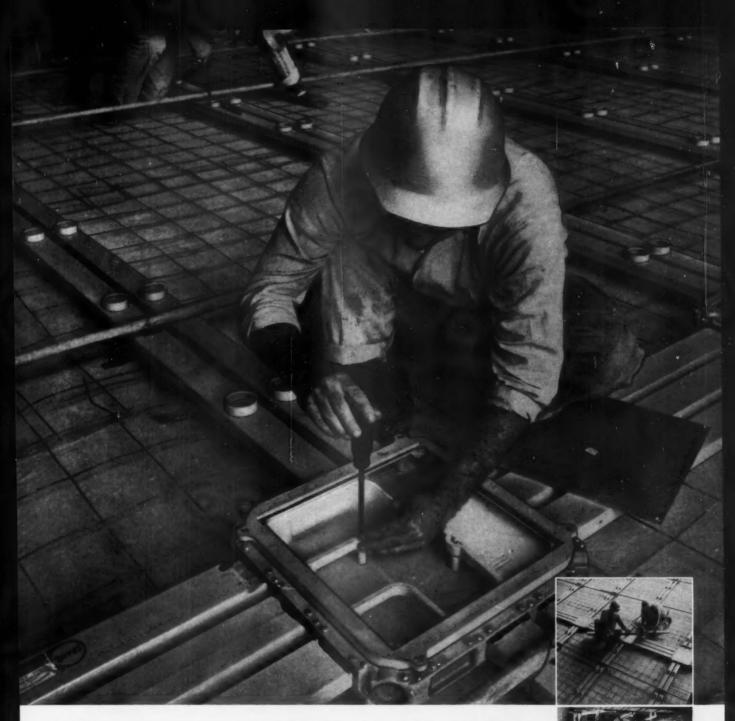
HARO

John Haro, AIA, an associate of Albert Kahn Associated Architects and Engineers, Inc., Detroit, has been appointed chief architectural designer of the firm.

John A. McPherson, Jr., formerly with The McPherson Company, Greenville, South Carolina, has joined Lyles, Bissett, Carlisle & Wolff, architects-engineers, Columbia, South Carolina, as head of the firm's industrial engineering section.

Norman C. Emerick has opened an office for the practice of civil and structural engineering at 1011 North Calvert St., Baltimore, Md.

A new nuclear consulting firm, Nuclear Technology Corporation, has been formed with Joseph De Felice as president and headquarters in Irvington, New York. Consulting services available encompass all phases of nuclear analysis, design, and evaluation, including reactor physics, heat transfer, and



Flexible wiring system for Jacksonville City Hall with SPANG

Underfloor Duct and Headerduct. Three-duct runs of Underfloor Duct in concrete slab construction carry electrical, phone and intercom wiring on first floor. Upper 15 floors are served by Headerduct in cellular-floor construction. Simplicity of Spang Raceway Systems provided a time-saving, trouble-free installation. Future wiring changes can be made quickly, easily without costly reconstruction, making City Hall modern for years to come. For full information, write to Spang.

Architect: Reynolds, Smith & Hills, Jacksonville General Contractor: The Auchter Company, Jacksonville Mechanical Contractor: Henley and Beckwith, Jacksonville Electrical Contractor: Wesley Paxson Co., Jacksonville Spang Distributor: Ace Electric Supply, Jacksonville

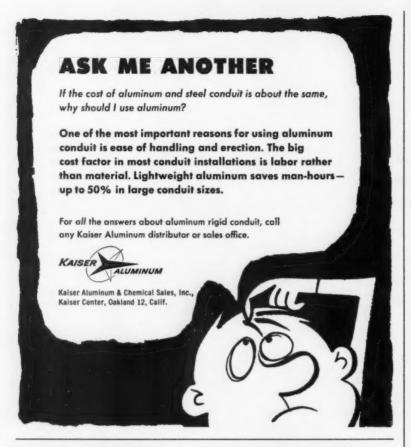


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Consulting Engineer St. Joseph, Michigan

fluid flow, shielding, reactor evaluation, and nuclear economics. De Felice was associated for the last six years with Nuclear Development Corporation of America, where he was manager of the preliminary design department.

McCreary-Koretsky Engineers (MKE) is the new consulting engineering firm created when Porter, Urquhart, McCreary & O'Brien (PUMO) dissolved due to the death of Colonel Leonard C. Urquhart in March 1960. MKE is continuing with the San Francisco facilities, personnel, and address of the former firm. It also has offices in Sacramento and Seattle.

Fred S. Dubin Associates, Consulting Engineers, Hartford, Connecticut, announce the appointment of Norman D. Kurtz as engineering administrative assistant to the partners, Fred S. Dubin and Harold L. Mindell. Kurtz will handle administrative matters concerned with the firm's growing government and industrial practice.

Renato G. Barreto has been appointed an associate of Paul Rogers & Associates, Inc., consulting engineers of Chicago. Barreto, who speaks several foreign languages, is a project engineer with the firm, and is expected to handle much of the firm's European work.

Gordon M. Jones, assistant vice president and director of construction, of The M. W. Kellogg Company, engineers and constructors, New York City, has been elected a member of the executive committee of the National Constructors Association.

Arthur B. Gallion, formerly Dean, School of Architecture, University of Southern California, has joined the Honolulu office of Harland Bartholomew and Associates. As director of planning, Gallion will supervise all planning work in the Honolulu office.

STEPHENS-ADAMSON CURVE CROWN® STEPHENS-ADAMSON DULLEYS

FEATURING "SQUEEZELOCK" HUB DESIGN
FOR GREATER BELT TRAINING EFFECT ... REDUCED BELT WEAR

STURDY RIM CONSTRUCTION

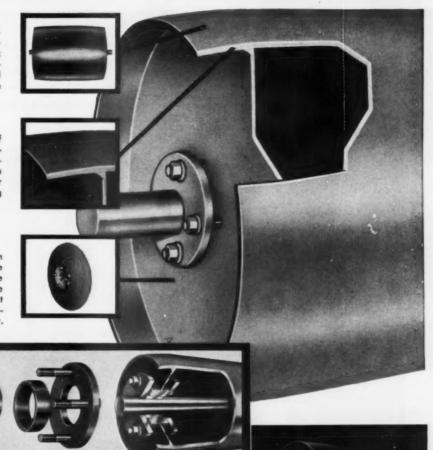
Pulley rims are made of onepiece construction, formed absolutely round under hydrostatic pressure. The only seam is machine-welded both inside and out to insure 100% penetration of welds.

CURVE CROWN® DESIGN

Curve Crown on outer ends of rim accurately formed. Revolutionary design eliminates conventional center peak — high point for belt stretch and wear — while increasing belt training effect more than 100%.

ACCURATE END PLATE ASSEMBLY

End plates are machined on both the O.D. and I.D. to insure concentricity between the bore and the outer rim. They are pressed into position for tight fit-up and submerged arcwelded for maximum efficiency.



"SQUEEZELOCK"® HUB Revolutionary design of "SQUEEZELOCK" Hub provides gripping power for full torque transmission without the use of keyways and eliminates distorting loads against pulley end plates. Two split tapered bushings are wedged against shaft and pulley end plates by two independent hub plates which are squeezed together by tightening four large diameter bolts.





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5,500 ALUMINUM fittings and

Only Killark provides such design flexibility!

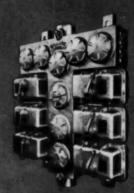
Killark knows that modern designers must have freedom to choose from a complete, selection of electrical fittings and fixtures. That's why the Killark line contains more than 5,500 enclosures of all types and sizes. No matter how unusual or varied the requirements, whether in hazardous or non-hazardous locations, Killark can supply them all from this vast stock.

Killark fittings and fixtures give added design flexibility because they are cast only from aluminum. This means they are non-sparking and non-magnetic. Their light weight is an important factor in many applications; they're easier to install. They're ideal for certain areas where corrosion is a problem, permanently rustproof, non-staining. They dissipate heat much more efficiently than conventional metals.

Remember these decided Killark advantages when planning specifications. You'll find that Killark—and aluminum—serves your design needs best.

Rillard PROVIDES ENCLOSURES FOR CONTROL

EQUIPMENT... All large junction boxes, as well as enclosures for motor starters, dirout breakers, disconnect switches and panel boards are readily available from your Killark dealer. These all-aluminum flutures, in weather-proof a explosion-proof styles, are designed to give maximum efficiency. They're ribbed for greater strength and faster heat dissipation so vital to accurate operation of thermal devices. They feature space-saving rectangular construction, convenient mounting lugs.



PANEL BOARDS

Complete with specified breaker, wiring, seals, contactions—ready to install. One place wiring trough, rectangular or "T" siyle. Wide cover openings give plenty of hand room. Custom assembled for your job.

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Tillark PROVIDES COMPLETE ASSEMBLIES FOR CONTROL RACKS

A special Killark engineering service provides complete assemblies of all sizes and types (such as switch rack assemblies) designed and built to meet an exact need. For example, Killark will prepare and submit a preliminary blueprint according to specifications. After approval, the entire unit is assembled, wired, and sealed at the factory—the Killark-engineered unit is delivered ready to connect to power. This custom service saves an enormous amount of assembly work at the job site.

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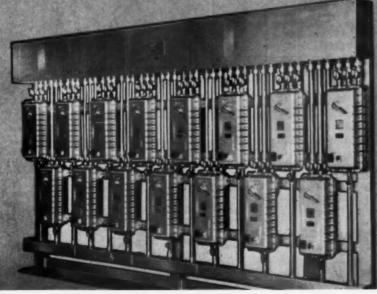
fixtures from which to choose...

Killark PROVIDES A COMPLETE LINE OF **CONDUIT FITTINGS**

The Killark line includes hundreds of aluminum conduit fittings, plus light fixtures, pilot light stations, flush switch boxes, instrument boxes, seal-off fittings, cord connectors, flexible couplings, splice boxes, plugs and receptacles, entrance fittings, and many other kinds of enclosures for hazardous and non-hazardous locations. Killark wholesalers can supply the correct item for any need, in the exact size needed—and do it promptly from stock.









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- garage and parking lot adjacent
 close to the Stadium &
- close to the Stadium &
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Corrosion Control • F.C.C. Certification Tests
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Consulting Engineers' Calendar

Sept. 8-9. American Society of Civil Engineers; Conference on Electronic Computation, Hilton Hotel, Pittsburgh, Pennsylvania.

Sept. 15-16. American Society of Mechanical Engineers; Engineering Management Conference, Hotel Morrison, Chicago, Illinois.

Sept. 21-23. American Institute of Electrical Engineers and American Society of Mechanical Engineers; 1960 National Power Conference, Bellevue Stratford Hotel, Philadelphia, Pennsylvania.

Sept. 25-28. American Institute of Chemical Engineers; National Meeting, Hotel Mayo, Tulsa, Oklahoma.

Sept. 26-28. American Society of Mechanical Engineers; Petroleum Mechanical Engineering Conference, Jung Hotel, New Orleans, Louisiana.

Sept. 26-30. Instrument Society of America; Fall Instrument-Automation Conference & Exhibit, Annual Meeting, Coliseum, New York, N. Y.

Sept. 27-30. Prestressed Concrete Institute; 6th Annual Convention, Statler-Hilton, New York, N. Y.

Oct. 2-6. Water Pollution Control Federation; 33rd Annual Meeting, Convention Hall, Philadelphia, Pa.

Oct. 3-5. National Association of Corrosion Engineers and University of California; Corrosion Short Course, San Francisco, California.

Oct. 3-5. National Association of Corrosion Engineers and University of Oklahoma; Corrosion Short Course, Campus, Norman, Oklahoma.

Oct. 5. Society of Plastics Engineers, Inc.; Technical Conference — "Plastics vs. Corrosion," Mark Hopkins Hotel, San Francisco, California.

Oct. 9-12. American Society of Mechanical Engineers and American Institute of Electrical Engineers; Fuels Conference, Daniel Boone Hotel, Charleston, West Virginia.

Oct. 10-14. American Institute of Electrical Engineers; Fall General Meeting, Chicago, Illinois.

Oct. 10-14. American Society of Civil Engineers; Annual Convention, Hotel Statler, Boston, Massachusetts.

Oct. 25. Association of Consulting Chemists & Chemical Engineers, Inc.; Annual Meeting & Symposium, "The American Consultant Outside USA," Hotel Shelburne, New York, N. Y.

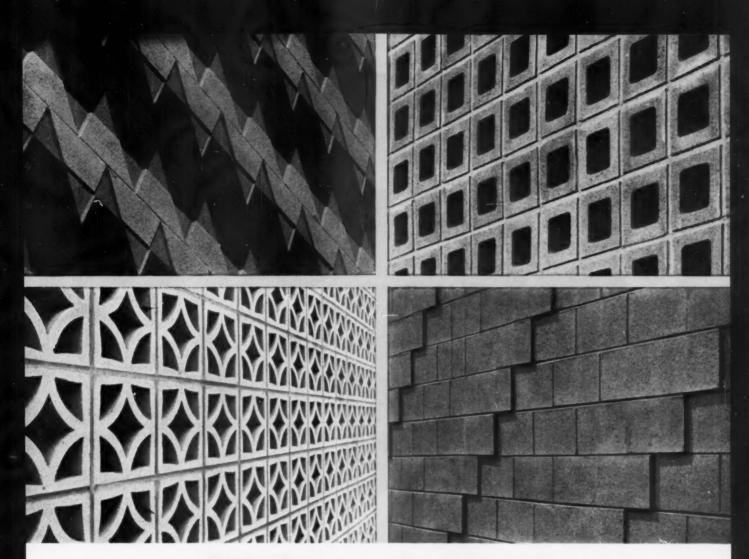
Oct. 31-Nov. 2. American Concrete Institute; 13th Regional Meeting, Pioneer Hotel, Tucson, Arizona.

Nov. 10-11. Kansas City Section, American Society of Civil Engineers; Power Conference, Continental Hotel, Kansas City, Missouri.

Nov. 15-16. Purdue University; Symposium on Engineering Applications of Probability and Random Function Theory, Campus, Lafayette, Indiana.

Nov. 15-17. Building Research Institute; Fall Conferences, Shoreham Hotel, Washington, D. C.

Nov. 27-Dec. 2. American Society of Mechanical Engineers; Annual Meeting and 24th National Exposition of Power and Mechanical Engineering, Statler-Hilton, New York, N. Y.



Plain or fancy...

you can strengthen just about any kind of masonry wall with Dur-o-wal

Hats off to today's architectural designers for a new world of beauty in concrete masonry. And orchids to the modern builders who are making that beauty last with Dur-o-wal. It's the rare block pattern, plain or fancy, that does not permit America's most practical, most widely used, most widely proved masonry wall reinforcement. Dur-o-wal is versatile.

Dur-o-wal's trussed, butt-welded construction-with deformed rods

that lay straight and flat-has been engineered to do a job. Increases the flexural strength of a masonry wall at least 71 per cent, as much as 261 per cent, depending on the weight Dur-o-wal used, number of courses, and type of mortar. This makes for truly permanent masonry wall construction and looks.

For technical details, write to any of the Dur-o-wal locations below. See us in Sweet's.



Two engineered products that meet a need. Dur-o-wal reinforcement, shown above, and Rapid Control Joint, below. Weatherproof neoprene flanges on the latter flex with the joint, simplify the caulking problem.

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Masonry Wall Reinforcement and Rapid Control Joint

RIGID BACKBONE OF STEEL FOR EVERY MASONRY WALL

DUR-O-WAL MANUFACTURING PLANTS

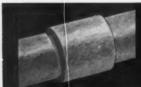
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This thrifty pipe is infiltration-proof, even when external water pressure is 25 psi. Prevents your sewer system from reaching full capacity years ahead of schedule, due to water infiltration. "K&M" Asbestos-Cement Sewer Pipe, with exclusive, patented FLUID-TITE Coupling, forms a permanently tight seal.

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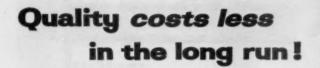


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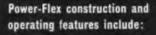
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CM Power
and Free
conveyor
system

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shows trolley mounted Telematic route selector dispatch head and transistorized switch control station. Telematic automatically guides carrier to any station in the system.



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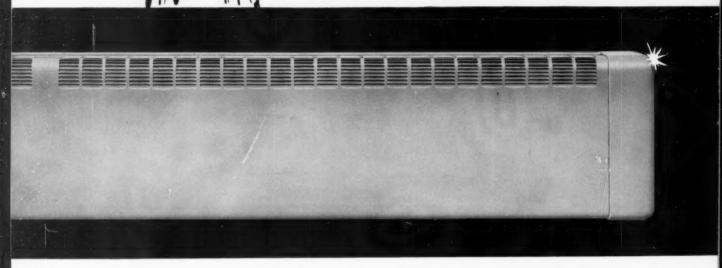
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